European Agency for Safety and Health at Work

WORKING ENVIRONMENT INFORMATION

EN

LITERATURE REVIEW

ISSN 1831-9351

LEGIONELLA AND LEGIONNAIRES' DISEASE: A POLICY OVERVIEW

TE-WE-11-003-EN-N

European Agency for Safety and Health at Work

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EU-OSHA would like to thank *its Focal Point network* and *the TC Working Environment Expert Group* for their valuable feedback on the draft report.

Cataloguing data can be found at the end of this publication.

Luxembourg: Publications Office of the European Union, 2011

ISBN: 978-92-9191-488-3

doi 10.2802/7798

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Introduction

Infections caused by the bacterium *Legionella pneumophila* and related *Legionella* species first emerged in the 1970s associated with contaminated water systems operating at above ambient temperature. The diseases caused by these bacteria are known collectively as legionellosis and range in severity from mild febrile illness (Pontiac fever) to a potentially fatal form of pneumonia (Legionnaires' disease). Bacteria of the genus *Legionella*e are ubiquitous in small numbers in many natural water systems, but are particularly well suited to multiplication in warmer artificial aquatic environments in the built environment, such as cooling towers; water systems in hotels, homes, ships and factories; respiratory therapy equipment; fountains; misting devices; and spa baths (also known as spa pools, hot tubs and whirlpool baths).

Infection is via inhalation of aerosols, mists or droplets of contaminated water and risk of infection is increased by environmental factors that may contribute to contamination and to the aerosolisation of contaminated water. All humans are susceptible, but increased personal risk factors include age, illness, immunosuppression and smoking. Cases of Legionnaires' disease are generally classified according to the likely source of infection, i.e. community-acquired (industrial or domestic sources), travel-associated (overnight stays in hotels, etc.) or nosocomial (hospital acquired).Table 1 summarises risk factors for infection for each category.

Table 1: Risk factors for *Legionella* infection, by category

	Community acquired	Travel associated	Nosocomial
Modes of transmission	Inhalation of contaminated aerosol	Inhalation of contaminated aerosol	Inhalation of contaminated aerosol, aspiration, wound infection
Sources of *Legionella*	Cooling towers; hot- and cold-water systems; spa pools, thermal pools, springs; humidifiers; domestic plumbing; potting mixes and compost	Cooling towers; hot- and cold-water systems; spa pools, thermal springs and pools; humidifiers	Cooling towers; hot- and cold-water systems; spa pools, natural pools, thermal springs; respiratory therapy equipment; medical treatment
Reservoir of *Legionella*	Industrial sites, shopping centres, restaurants, clubs, leisure centres, sports clubs, private residences	Hotels, cruise ships, campsites, shopping centres, restaurants, clubs, leisure centres, sports clubs	Hospitals, medical equipment
Risk factors (environmental)	Proximity to sources of transmission, poor design or poor maintenance of cooling water systems, inadequate staff training	Stay in accommodation designed for short stays and seasonal use; intermittent room occupancy and water use; intermittent water supply and fluctuating water temperature control; complex water systems; lack of trained staff to manage water systems	Complex water distribution system, long pipe runs, poor water temperature control, low water flow rates

Risk factors (personal)	Age >40 years; male; underlying disease such as diabetes; chronic heart disease; smoking; immunosuppression (especially with glucocorticosteroids and chronic debilitating illness); structural pulmonary comorbidity; chronic renal failure; recent travel; haematological malignancy; iron overload; other immunosuppression	Age >40 years; male; heavy smoking, alcohol abuse; change in lifestyle; underlying disease such as diabetes; chronic heart disease, other immunosuppression	Age >25 years; transplant patient; other immunosuppression; surgery, especially head and neck; cancer, including leukaemias/lymphomas; diabetes; treatment with respiratory devices; chronic heart/lung disease; smoking, alcohol abuse

Source: Bartram et al., 2007

About 20% of the cases of legionellosis detected in Europe are considered to be associated with travel, which presents problems in identifying the source of infection. The case definitions for Legionnaires' disease summarised in Table 2.

Table 2: Useful definitions for epidemiological monitoring

Legionnaires' disease	Case definitions
Confirmed cases	Clinical or radiological evidence of pneumonia and a microbiological diagnosis by culture of the organism from respiratory specimens, or a fourfold rise in serum antibody levels against *L. pneumophila* serogroup (sg) 1, or detection of *L. pneumophila* antigen in urine or positive direct immunofluorescence assay (DFA) test.
Presumptive cases	Clinical or radiological evidence of pneumonia and a microbiological diagnosis of a single high antibody level against *L. pneumophila* sg 1 or a seroconversion demonstrated against *Legionella* species and serogroups other than *L. pneumophila* sg 1.
Healthcare acquired (nosocomial) cases	Depending on length of stay in hospital before onset and environmental investigation results, cases are definitely, probably or possibly nosocomial.
Travel-associated cases	Case associated with one or more overnight stays away from home, either in the country of residence or abroad, in the 10 days before onset of illness.
Travel-associated clusters	Two or more cases stayed at the same accommodation, with onset of illness within the same two years.
Community clusters	Two or more cases linked by area of residence or work, or places visited, and sufficient closeness in dates of onset of illness to warrant further investigation.
Community outbreaks	Community clusters for which there is strong epidemiological evidence of a common source of infection, with or without microbiological evidence, and in response to which control measures have been applied to suspected sources of infection.
Domestically acquired cases	Depending on the elimination of all other sources of exposure, and the case being known to have used the domestic water system during the incubation period, and environmental and clinical results positive for *Legionella*, cases may be suspected, probably or definitely domestically acquired.

Source: Bartram et al., 2007

The optimum growth temperature for *Legionella*e is above ambient, usually between 20 and 45 ºC. *L. pneumophila* is thermotolerant, can withstand temperatures of 50 °C for several hours, and has been isolated from hot-water systems up to 66 ºC. However, it is destroyed above 70 ºC. Water systems in the built environment, such as hot water plumbing systems, air-conditioners and spa baths use water in the temperature range that encourages *Legionella* growth, and many of these systems potentially produce aerosols, i.e. the route of infection.

Using temperature as a means to control *Legionella* growth therefore means maintaining water systems above or below the optimum growth range, i.e. below 25 °C, and ideally below 20 °C for storage and distribution of cold water or at 60 °C for stored water, with distributed water achieving 50 °C within 1 minute at outlets [1].

Although *L. pneumophila* will survive in sterile or pure water, it is more likely to multiply in non-sterile tapwater. Studies have shown that *L. pneumophila* survived for long periods in sterile distilled water and sterile tapwater, but did not multiply [2, 3]. Other microorganisms allow or even enhance *Legionella* multiplication. For example, naturally occurring *L. pneumophila* grew for prolonged periods in model systems seeded with a mixed microflora from a potable water system when fed solely with filtered, sterilised drinking water [4, 5]. This suggests that *Legionella* will grow using nutrients already available in tapwater, and these nutrients may be supplied, directly or indirectly, by other species of bacteria or other associated microorganisms [6, 7]. *L. pneumophila* has been shown to be associated with many different microorganisms from aquatic sources. These microorganisms include protozoa, *Fischerella* spp. and other bacteria [8, 9, 10, 11, 12].

Rowbotham (1980) [13] was the first to report a relationship between amoebae and *L. pneumophila*, and *Legionella*e were subsequently confirmed as facultative intracellular parasites. Protozoa are an important vector for the survival and growth of *Legionella* within natural and artificial environments, and have been detected in environments implicated as sources of legionellosis. However, not all amoebae are acceptable hosts, indicating a degree of host specificity. They can multiply in 14 species of protozoa, including *Acanthamoeba, Naegleria* and *Hartmanella* spp., the ciliates *Tetrahymena pyriformis*, *Tetrahymena vorax*, [3, 12, 13, 14, 15] and one species of slime mould [13].

In the natural environment, *L. pneumophila* proliferates intracellularly in protozoa. Once an amoeba has ingested it, the survival of *L. pneumophila* depends on the temperature of the water. At 22 °C, the amoebas digest the bacteria, [16] whereas at 35 °C the bacteria can proliferate inside the amoeba [13]. Protozoa also help to protect *Legionella* from the effects of biocides [17] and thermal disinfection [18]. *Legionella*e can survive in encysted amoebal cells, [19, 20] which may be the mechanism by which *L. pneumophila* can survive in aerosols and in adverse environmental conditions [21, 22, 23].

Biofilms – thin layers of microorganisms that may form slime on surfaces in contact with water – are also important to the survival and growth of *Legionellae*. They are more capable of surviving in biofilms than living free in water. Various factors increase the likelihood of biofilm formation in a water system, including the presence of nutrients, both in the source water and in the materials of the system, scale and corrosion, warm water temperatures, and stagnation or low flow such as in the dead ends of distribution system pipework and storage tanks. Once established, biofilms are difficult to remove from complex piping systems. The presence of scale and corrosion in a system will also increase the available surface area to allow microniches to form that protect biofilm organisms from circulating disinfectants. Scale and corrosion also increase the concentration of nutrients and growth factors, such as iron, in the water system.

Heavy biofilm growth can restrict or block pipework, leading to poor flow and stagnation and increased risk of *Legionella* growth. Materials used in the construction of a water system can also affect the growth of biofilms. Some plumbing materials support or enhance growth of microorganisms, including *Legionella* spp. [5]. Parts made of natural substances, such as rubber gaskets, provide a nutrient-rich substrate and are preferentially colonised by microorganisms, and some plastics leach nutrients into a water system. Microorganisms will even grow on the surface of copper piping once the surface has been conditioned.

Biofilms and protozoa present a twofold protective effect for the *Legionellae* in a water system, firstly because the increased organic load can inactivate disinfectant. Secondly, bacteria (including *Legionella* spp.) grown inside protozoa are more tolerant of chlorine and other antimicrobial agents at concentrations above those commonly used to disinfect water supplies and above concentrations shown to be lethal under laboratory conditions [17].

Most engineered water systems, especially complex ones such as in those found in healthcare facilities and hotels, will have areas containing biofilms, even when the system is well maintained. When control measures, such as temperature control or disinfection regimes, are relaxed, microorganisms will quickly multiply, increasing the risk of *Legionellae* colonisation. *Legionella* contamination can originate even from small areas of a water system that are not exposed to temperature fluctuations or circulating disinfectant, and act as a 'seed' to the rest of the system.

In healthcare, showers may be the main source of nosocomial legionellosis but not the only one, as other water outlets such as humidifiers, respiratory devices and nebulisers that have been filled or cleaned with tapwater can also spread *Legionella* and have been reported as sources of infection [24, 25, 26, 27, 28].

Community-acquired cases of legionellosis can almost always be attributed to inhalation of aerosols from devices such as cooling towers, hot tubs, industrial equipment and indoor fountains [29, 30, 31]. Other systems implicated in the spread of legionellosis via aerosols include domestic plumbing systems [32], misting devices used in food displays [33], natural thermal springs [34] and thermal spas [35].

A range of evaporative cooling systems are used in industrial processes and air-conditioning systems to dissipate heat by using water as a heat-exchange medium. Air forced or induced through a tower is put in direct contact with water either as a spray or on the surface of packing material used to maximise the surface area. Drift eliminators are used to minimise the loss of water from the system with the exiting air, but it is estimated that about 2% of the water used in wet cooling systems escapes as an aerosol. It can drift more than 500 metres, in a few cases up to several kilometres, from its source and, when contaminated by *Legionellae*, has been attributed to a large proportion of community clusters or outbreaks of infection. *Legionella* infections have frequently been associated with sources at distances of up to 3.2 kilometres [36] with recent evidence that infection may be possible at even longer distances [37].

Legionellosis is not only a public health disease, but also presents a risk to workers. Workers in healthcare, hotel and leisure industries are as likely as patients and visitors to be exposed to *Legionella*-contaminated aerosols. Workers in industrial premises may be exposed, as may those in premises neighbouring those with contaminated cooling towers. Furthermore, workers involved in the maintenance of water systems in healthcare, hotel and leisure, office, domestic or industrial premises will be at increased risk of exposure to *Legionella* contamination in aerosols.

A recent study has shown that an outbreak of Legionnaires' disease could be attributed to a metal product aqueous pre-treatment process in a construction equipment manufacturing plant. Drainage, cleaning and biocide treatment using isothiazolone eliminated ***Legionella*** from the system [38].

Data from the European Centre for Disease Control (ECDC) provides a 10-year trend for legionellosis incidence in Europe. For the period 1995 to 2004, from all 25 EU Member States, Iceland and Norway, the overall incidence of legionellosis increased between 1996 and 2002. Since 2002 however, the incidence has remained stable at around one per 100,000. It must be noted that complete data for the whole period were available from only 13 countries (Czech Republic, Denmark, Finland, France, Ireland, Italy, Latvia, Malta, Netherlands, Slovenia, Sweden, United Kingdom and Norway). This trend may partly be explained by the greater availability of improved diagnostic methods such as urine antigen testing. The most recent data available (2005) gave a total of 4,189 legionellosis cases reported by 23 countries. The highest incidence of 3.36 per 100,000 was in Spain, followed by Iceland with 2.38 per 100,000. The overall incidence rate for 2005 was estimated at 1.06 per 100,000.

A breakdown of cases into nosocomial, community and travel-associated was reported by Bartram et al., (2007) [39] from data gathered by the European Working Group for *Legionella* Infections (EWGLI), as shown in Table 3. These data suggest that the greatest increases in cases are in the categories of community-acquired and travel-associated cases.

Table 3: Europe-wide reported cases of legionellosis by category, 1997–2004

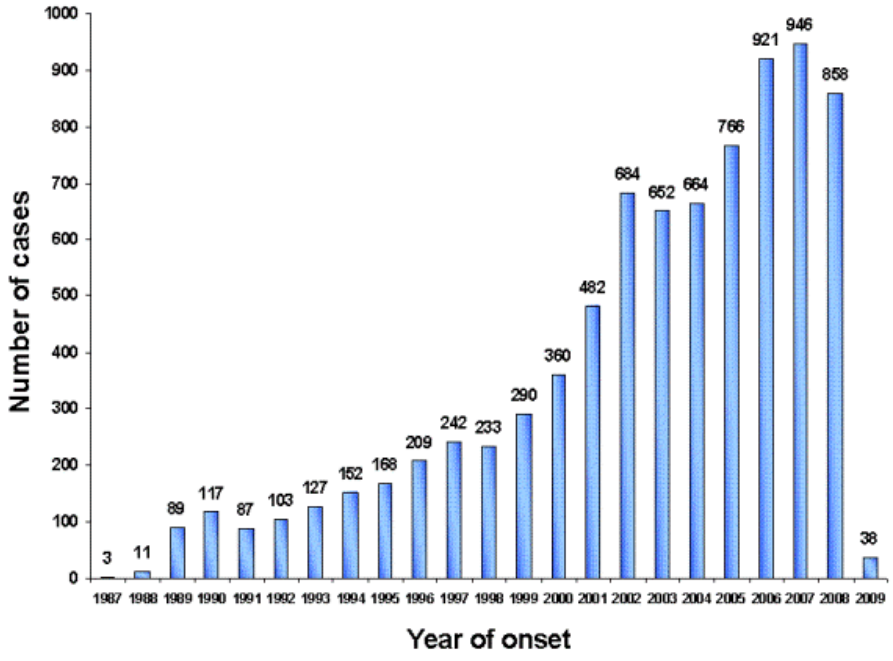
Category of Cases	Year										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Nosocomial	151	157	105	215	181	195	275	333	277	347	309
Community	186	270	617	388	478	679	659	1475	1767	2106	1884
Travel associated	190	194	246	290	297	439	500	674	944	927	984
Not known	634	634	595	451	486	823	722	988	1691	1072	1369
Total	1161	1255	1563	1344	1442	2136	2156	3470	4679	4452	4546

Source: Bartram et al., 2007

In Europe, the total number of reported travel-associated cases has increased greatly since 1987, mainly showing a year-on-year rise and peaking at 946 in 2008 (Figure 1). It is hard to determine how much this is a true reflection of increased cases and how much it is influenced by better recognition and diagnosis, but increased global travel, rising use of air-conditioning and other water systems such as spa baths in the leisure industry, together with economic pressure leading to reduced maintenance budgets, may also play a part.

In summary, the source and ecology of *Legionella* is well known, as are the means of control in man-made water systems. Methods of diagnosis, epidemiology and data recording have improved greatly. Despite this improvement the number of cases has been increasing in the recent past. The numbers now appear to have stabilised, but are not falling. Therefore, more needs to be done to improve recognition of risk factors and to improve controls.

Figure 1: Europe-wide reported cases of legionellosis per year, 1987–2009



Data from European Working Group for *Legionella* Infections (EWGLI)
http://www.ewgli.org/data/graph_of_cases.htm; as of February 2009

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2. Legionella and Occupational Safety and Health (OSH)

Since its first positive identification in 1976 [1, 2], Legionnaires' disease was considered for many years primarily a public health issue. In most cases the exposure to *Legionella*e bacteria resulted from man-made systems (cooling towers, evaporative condensers, whirlpools and spas, humidifiers etc.). The early recorded outbreaks or epidemics of Legionnaires' disease were related to hospitals or health centres [3-8], hotels [1-3, 9-10], shopping centres [11,12], meat packing plants [13], garment industries [14], office buildings [15, 16], food stores [17], car manufacturing plants, [18] and even nuclear power stations [19]. It was not always easy to detect the source of the infection but some important features were common in most cases. Cooling towers were often implicated. In many cases the links between air intakes and cooling towers were important and no care was taken to minimise them. Maintenance issues were prominent and *Legionella* has been demonstrated to be virulent at 500 metres from the source of contamination [20].

Gradually it has been recognised that Legionnaires' disease not only affects the general public, guests in hotels or patients in hospitals, but also the working population, in particular maintenance technicians of air-conditioning or water supply systems [21], consequently *Legionella* is also an occupational health issue. More recent studies have strengthened this finding. It has been proved that workers in places where mist machines are present [22], dental practitioners [23], workers of offshore oil and gas installations [24], welders [25], vehicle washers [26], miners [27], healthcare workers [28], workers in biological treatment plants [29], workers in an agricultural equipment manufacturing plant [30] and workers in the forestry industry [31, 32] could all be exposed to *Legionella*. The suspected sources of contamination in these studies were not always easy to trace. The search may be influenced by the current knowledge of the preferences of *Legionella*e bacteria with respect to different work environments. This may be misleading because some sources may be overlooked while other factors are overestimated. An example of the first type of error was a case when two workers contracted Legionnaire's disease in a welding area where a cooling fan was placed in the vicinity of a water tank. No *Legionella* pneumophila isolates were found in any linked cooling towers [25]. An example of the second is the strange fact that maintenance workers of cooling towers, who are considered to be at high risk, do not always show higher serological positivity against *Legionella* [33]. It is generally accepted that working areas with air-conditioning systems (e.g. cooling towers, evaporative condensers etc.), high humidity (e.g. with humidifiers and spraying systems producing fine aerosols) or systems containing stagnant warm water as in paper mills, print or textile plants, are amenable to the growth of *Legionella*. But given the fact that many machines and work environments may provide a pool for *Legionella*, risks from this bacterium are not specific for sectors or jobs. This fact might have influenced the governments' tendency to face *Legionella* primarily as a public health issue.

The last electronically available edition of the Encyclopaedia of Occupational Health and Safety of the International Labour Office (ILO) [34] mentions *Legionella* and Legionnaires' disease only briefly in chapters entitled 'Occupationally Acquired Infections of the Lung', 'Biological Contamination', 'Indoor Air Quality: Introduction', 'Control of Indoor Environments: General Principles', 'The Nature of Office and Clerical Work', 'Respiratory System: Structure and Function', and 'Plumber'. Very little information can be drawn from these articles. In a table in the chapter on occupationally acquired infections of the lung, Legionnaires' disease is considered to be a risk for health workers, laboratory workers, industrial laboratory workers and water well excavators but no further details are given about clinical presentation, diagnostic tests, epidemiology, treatment or public health controls as is done in the case of other lung infections. *Legionella* is also mentioned in the ILO's 'Code of practice on safety and health in the non-ferrous metals industries' [35].

In most European countries, risks from *Legionella* are covered by laws, decrees etc. based on Directive 2000/54/EC (On the protection of workers from risks related to exposure to biological agents at work) [36]. This is a general document aiming at the minimisation of health risks from biological agents at the workplace. It classifies biological agents into four categories according to their potential to cause diseases and the possibility for effective prevention and treatment. *Legionella* pneumophila and *Legionella* spp. belong to risk category 2. An agent of this category is one 'that can cause human disease and might be a hazard to workers (but) it is unlikely to spread to the community (and) there is usually effective prophylaxis and treatment available'. The Directive describes the requirements for notification to the competent authorities (e.g. labour inspectorates) before the commencement of the work in cases where group 2, 3 and 4 biological agents are used. The Directive requires the employer to develop a risk assessment scheme, thus reducing the risk to the workers by elimination or substitution of agents; to pay attention to prevention and control of exposure and to provide

information, adequate training and health surveillance services to the workers. Workers have to be given access to their personal data.

The European Risk Observatory, which is part of the European Agency for Safety and Health at Work, has published an 'Expert forecast on Emerging Biological Risks related to Occupational Safety and Health' [37]. The forecast was based on the responses of 109 experts from 21 European countries. These experts consider the 'poor maintenance of air-conditioning (whose use is increasing) and water systems (e.g. *Legionella*, aspergillosis in hospitals)' as one of the ten most important emerging biological risks. They also think that 'new knowledge about the presence of *Legionella* will help the correct diagnosis of symptoms so far wrongly attributed to other diseases like flu'. The same report states that although in Europe a network (EWGLI) has been set up to improve knowledge on the epidemiological and microbiological aspects of Legionnaires' disease, the network barely takes into account any occupational risk dimension. This means that there is a lack of reliable data on Legionnaires' disease in occupational settings. EWGLI categorises [38] the cases of legionellosis as nosocomial, community acquired and travel-associated. Travel-associated cases are usually only one-fifth to one-quarter of the total number of cases. It is likely that a major part of the two other categories are related to workplaces.

In some European countries relevant ministries, institutes, societies and associations have issued Guidelines, Codes of Practices, Safe working practices or other normative documents to tackle the risks from *Legionella* [39, 40, 41]. These are included in the Annexes to this Report, which describe national and international policies on *Legionella*. These documents usually contain technical protocols for the proper operation and maintenance of cooling towers, spas, etc. In some countries similar protocols are part of national standards. In others, such protocols are promoted by the cooling industry, the textile industry, trade unions, etc. Developed non-European countries follow a similar path [42, 43]. The majority of this information is available on the internet which greatly facilitates risk assessment in workplaces.

2.1. Case studies

2.1.1. Legionella in biological waste water treatment facilities

Finnish and Swedish waste water systems used by the forest industry were found to be exceptionally heavily contaminated with *Legionellae* in 2005. *Legionella* is not a forest industry specific issue, but its occurrence in other industrial branches has not been examined as reliably.

Examinations of waste water treatment facilities in the Finnish forest industry commenced in June 2005, triggered by Swedish reports of substantial *Legionella* concentrations in the aeration basins of biological waste water treatment plants in spring 2005. One employee of a Swedish paper mill was suspected of having contracted legionnaires' disease from bacteria in an aeration basin in November 2004.

The Finnish study, which was completed in the end of 2007, examined pulp and paper mill employee exposure to environmental bacteria that cause infections via the respiratory ducts. The study was conducted at 21 waste water treatment facilities and 292 employees were included in it.

The results indicated that:

- Persons working in waste water treatment plants had been exposed to *Legionella* bacteria as elevated levels of *Legionella* antibodies were discovered in their blood tests. However, increased occurrence of respiratory infections or any other clear effects were not detected.
- Atmospheric samples demonstrated that aerosols, which contain viable and cultivable *Legionella* bacteria and mycobacteria, were formed during ordinary use of aerating basins [44].

In 2006, two cases of legionnaires' disease were diagnosed via the occupational health services of the participating paper and pulp mills in employees working at two separate mills in Finland. These are the first reported cases of Legionnaires' disease in Finland associated with industrial waste water systems [45].

Swedish and Finnish studies have indicated that heavy contamination of active sludge basins with *Legionella*e is very common. Further, air samplings in Norway and France in the vicinity of active sludge basins revealed that viable *Legionella* cells can be isolated up to 180-270 meters downwind. It seems therefore likely that any waste water treatment plant with an active sludge basin under

aeration can contain higher concentrations of *Legionella* bacteria and also produce aerosols with *Legionella*e [45].

In addition, some of these waste water treatment plants use cooling towers to lower the waste water temperature. Water treatment plants with active sludge basins should be considered as a possible source of community acquired *Legionella* infections, directly or indirectly via cooling towers.

These findings suggest that the clinicians should consider legionnaires' disease when treating patients with pneumonia from these industrial settings [45].

Waste water cooling towers should be cleaned and maintained in accordance with the European and WHO *Legionella* guidelines. Developing ways to lower *Legionella* concentrations in waste water systems is the next step in diminishing the risk of *Legionella* infection.

Personnel working in biological waste water treatment facilities are required to wear respiratory protective equipment which prevent exposure to the bacteria.

In 2010, a research project was carried out in cooperation with the Finnish Institute of Occupational Health. In the project a guide was developed for the assessment and control of microbiological risks in the working environment in the pulp and paper industry [44].

2.1.2. Pontiac fever at a sewage treatment plant in the food industry

In August 1997, during a hot and humid summer period workers became ill with fever and flu-like symptoms after repairing a decanter for sludge concentration at a sewage treatment plant in the food industry in Denmark. The plant treated organic industrial waste water from the company. The sewage sludge from the plant was concentrated by centrifugation in two uncovered decanters in the decanter house. The workers were repairing one of the decanters over a period of 10 days in the decanter house, a small closed room, while the other decanter was in operation emitting aerosol to the environment, to which the workers were exposed.

The workers were wearing B2-filter masks when exposed. This type of mask does not protect against smaller particulate matter such as aerosols, only against chemical substances that are absorbed on the surface.

All five patients were seen and examined in the Department of Occupational Medicine. Furthermore two of the workers had recurrent illness and were examined during hospitalization. Outbreak features were consistent with Pontiac fever and positive antibody titers to *Legionella pneumophila* were found in blood from all 5 patients. *Legionella pneumophila* was cultured in high amounts from sludge from the decanter. It was concluded that the fever was caused by *Legionella pneumophila* emitted to the environment by the uncovered decanter. This is the first work-related outbreak of legionellosis described in Denmark.

Procedures for preventing new cases were established: the decanter has been enclosed, room ventilation has been established, and the workers are required to wear air-line equipment inside the decanter house [46].

2.1.3. Professional Drivers Exposed to Legionella

A source of infection is rarely identified for sporadic cases of Legionnaires' disease. Researchers at the UK Health Protection Agency found that professional drivers are five times more commonly represented among community acquired sporadic cases in England and Wales than expected. The researchers therefore investigated possible risks related to driving or spending time in a motor vehicle.

A case control study including all surviving community acquired sporadic cases in England and Wales with onset between 12 July 2008 and 9 March 2009 was carried out. Cases were contacted by phone and controls were consecutively recruited. The questionnaire included questions on driving habits, potential sources in vehicles and known risk factors. 75 cases and 67 controls were included in the study.

Multivariable analysis identified two risk factors linked to vehicle use associated with an increased risk of Legionnaires' disease: driving through industrial areas and driving or being a passenger in a vehicle with windscreen wiper fluid not containing added screenwash. Not adding screenwash to windscreen wiper fluid is a previously unidentified risk factor and appears to be strongly associated with community acquired sporadic cases of Legionnaires' disease. The researchers estimated that around 20% of community acquired sporadic cases could be attributed to this exposure. A simple recommendation to use screenwash may mitigate transmission of *Legionella* bacteria to drivers and passengers [47].

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3. Conclusion

The aim of this policy overview report is to present the regulatory framework in the European Union and in selected non-EU countries on *Legionella* spp. and Legionnaires' disease, along with other normative documents related to the practical application of this legislation (e.g. standards, guidelines, guidance, codes, etc.). Therefore, the main idea is to determine how legislation is translated into policy and what kind of events (e.g. outbreaks on a local level) or decisions (e.g. directives on European level) have influenced the current policy for protection of both the general population and workers.

The report examines the present policy of international organisations such as the WHO or ISO, of regional economic and political unions like the European Union and of standardisation bodies like CEN, of the EU Member States, as well as the policy of other non-EU countries, either European or non-European. It is obvious that given the wide scope of the review and the limited space available the final picture cannot be equally clear or detailed in all its aspects or institutions examined. Nevertheless, some trends are evident and can be made comprehensible if put in a historical perspective.

Fist of all, Legionnaires' disease, like any other infectious disease, is primarily a public health issue. Public health protection has a long history in Europe. It dates back at least to the eighteenth century when port authorities denied access to ships from other ports suspected of exporting infected travellers or contaminated goods. Industrialisation aggravated living conditions, especially in big urban centres. The first public health measures against the spread of infectious diseases were aimed at protecting the life of people as citizens, not as workers. Gradually, under the pressure of the emerging trade unions, institutions like the Berufsgenossenschaften (institutions for statutory accident insurance and prevention) in Germany and, later on, similar institutions in other European countries, promoted the idea of prevention of occupational diseases. International events such as the Russian Revolution and the Great Depression of the 1930s accelerated the formation of international and national institutions promoting specific occupational safety and health policies. The International Labour Organisation (ILO) was founded in 1919 and most social security systems in Europe date from the period between the two World Wars. After the Second World War, OSH issues were always present, in one or another form, in official policies of the European countries. Nevertheless, the gap between public health policies, especially those concerning infectious diseases, and OSH policies was never fully bridged, although some countries have tried to deal with such problems in an integrated way.

Since 1976, when the bacterium *Legionella* spp. was recognised for the first time as the cause of a severe pneumonia outbreak in Philadelphia (USA), Legionnaires' disease has been viewed primarily as a public health issue. Most efforts on an international and national level try to protect the general public, for examples patients in hospitals, tourists, swimming pool and spa users, and are targeted at the quality of drinking or recreational water and water supply systems, or at the quality of indoor air and air-conditioning systems.

The European Working Group for Legionella Infections (EWGLI) was formed in 1986. Its scope was to improve knowledge on the epidemiological and microbiological (clinical and environmental) aspects of Legionnaires' disease. In 1987 the members of EWGLI established the European surveillance scheme for travel-associated Legionnaires' disease (EWGLINET). Collaborators are usually national or regional representatives from public health and microbiology institutes in each country. EWGLINET has issued European guidelines for the control and prevention of travel-associated Legionnaires' disease. The statistics published yearly by EWGLI are probably the most accurate data on Legionnaires' disease, cases but they focus on tourism and the occupational risk dimension is barely considered. Unfortunately, no other reliable sources of statistical data on Legionnaires' disease in occupational settings exist. In 2010, EWGLI has been renamed as the European Legionnaires' Disease Surveillance Network (ELDSNet) and is coordinated and managed since then by the European Centre for Disease Prevention and Control (ECDC). ECDC is an independent agency of the European Union tasked with strengthening Europe's defences against infectious diseases, established in Stockholm in 2005. Since 2007 ECDC has had experts in place covering 49 infectious diseases that are notifiable at EU level. Legionnaires' disease is one of them. In a report by EWGLI for the period 1997–2004, the cases of legionellosis were categorised as nosocomial, community acquired and travel-associated. It is interesting to note that travel-associated cases make up just one-fifth to one-quarter of the total number of cases, It is not clear what is the proportion of work related cases in the two other categories (nosocomial and community acquired).

On a European level, efforts to combat *Legionella* once again centre on public health issues. The European Union has issued a series of directives on the quality of drinking water, the quality of bathing water and indoor air quality. *Legionella* is not always mentioned in these directives. Nevertheless, through their transposition into national legislation the directives play an important role in prevention and help in constructing a more detailed legal framework with special reference to *Legionella*. On the other hand, there is already a European directive concerning biological agents in the workplace, including *Legionella*.

On a national level, almost all European countries have adopted public health policies against *Legionella*, while a few of them mention it as a special issue in their OSH legislation. In most of these cases, risk assessment is promoted by other normative documents such as technical rules, guidance, codes, etc. These documents are very useful for the actual implementation of OSH legislation in practice, because they contain technical protocols for the maintenance of cooling towers, spas or water supply systems. In some countries, such protocols are contained in standards, while in others protocols are contained in publications from responsible authorities, employers' organisations in the cooling industry, trade unions, municipalities, etc.

Legionnaires' disease, like other infectious diseases, should be better integrated into an OSH perspective as a matter of policy. In most cases the cause of this disease lies in systems found in workplaces whose faulty operation can affect not only the health of the general population but also that of the workers.

4. Annexes: Regulatory framework and related policies

4.1. Annex 1 - International organisations

4.1.1. World Health Organisation (WHO)

Introduction

The World Health Organisation has issued a fact sheet on legionellosis [1] that provides general advice on the prevention of the disease. The WHO refers to several sources from which *Legionella* infection may arise. There are guidelines on drinking water, recreational water use and sanitation on ships. There is also an extensive scientific report: 'Legionella and the prevention of legionellosis', published in 2007 [2]. It contains well-structured and practice-oriented chapters for risk management and prevention relating to water supplies in buildings, hotels and ships, cooling towers and evaporative condensers, hot tubs and spas, and healthcare facilities.

Policies

Recreational water use [3]

Legionnaires' disease is considered a high-severity health hazard when using recreational water. *Legionella* may be present in high numbers in natural spas with thermal spring water. They can also grow in poorly maintained hot tubs and heating, ventilating and air-conditioning (HVAC) systems. *Legionella* species can also multiply on filters, especially granular activated carbon filters. Most cases of legionellosis linked with recreational water use have been related to public and semi-public hot tubs and natural spas. Showers may present a greater risk of legionellosis than pool water. However, exposure to *Legionella* is preventable through the implementation of some basic management measures. These may include:

- filtration
- sustaining a continuous flow of disinfectant in hot tubs
- diluting the residual water with large quantities of fresh water (where disinfectants are not used)
- maintenance and cleaning of natural spas, hot tubs and pool equipment, as well as pipes and air-conditioning units.

It is less easy to control the growth of *Legionella* spp. in hot tubs than in pools, as the design and operation of hot tubs can make it difficult to achieve adequate residual disinfection levels in these facilities. Thus, in public and semi-public facilities the following measures are recommended:

- frequent monitoring and adjustment of pH and disinfectant levels (essential)
- programmed 'rest periods' to allow disinfectant levels to 'recover'
- requiring users to shower before entering the water
- controlling the number of users and the duration of their exposure
- thorough cleaning of the area surrounding the hot tub on a frequent basis (e.g. daily)
- complete draining and cleaning of the hot tub and pipework on weekly at least
- frequent backwashing and filter inspection
- good ventilation.

Samples of pool water from public and semi-public pools should be tested for *Legionella* and other microorganisms at regular intervals.

Authorities responsible for the management of recreational facilities should ensure the implementation of safety plans. Such plans should address not only pools and hot tubs but also other water systems, including cooling towers and evaporative condensers operating in these facilities.

Planning and management measures should provide:

- appropriate design, to minimise the available surface area within the pool and hot tub system and associated pipework to reduce the area for possible bacterial colonisation
- an adequate disinfection of residual water in pools and hot tubs
- proper maintenance and cleaning of equipment
- adequate ventilation.

Besides the above-mentioned activities, the following additional risk management measures are emphasised for hot tub facilities:

- ensuring a constant circulation of water in the hot tub
- programming 'rest periods' during hot tub operation, in order to discourage excessive use and also to allow disinfectant levels to 'recover'
- frequent inspection and cleaning of all filters, including backwash filters (e.g. at least daily and when triggered by a pressure drop)
- cleaning pool surroundings, inspection of the physical conditions of the hot tub (e.g. daily)
- replacing at least half the water in each hot tub (e.g. daily)
- completely draining hot tubs and thoroughly cleaning all surfaces and all pipework (e.g. weekly)
- maintaining and physically cleaning heating, ventilation and air-conditioning systems serving the room in which hot tubs are located (e.g. weekly to monthly)
- inspection of the sand filter (e.g. quarterly)
- ensuring staff are appropriately qualified and competent to operate the recreational facility
- verification of control measures that can include:
    - checking and adjusting residual disinfectant levels and pH (several times a day);
    - inspection and maintenance of cleaning operations (daily to weekly);
    - ensuring that Legionella levels are <1/100 ml.

Recommendations also exist for the frequency of routine sampling:

- disinfected pools, public, semi-public and heavily used: quarterly;
- natural spas and hot tubs: monthly.

If operational levels are exceeded (>1/100 ml), hot tubs should be shut down, drained, cleaned and refilled. Shock chlorination may be appropriate if filter colonisation is suspected.

In hot tubs and natural spas physical cleaning of surfaces is critical and high residual disinfectant concentrations (e.g. free chlorine >1 mg/l) may be necessary. Water sprays in swimming pools, and similar devices, should be periodically cleaned and flushed with disinfectant capable of eliminating *Legionella*. High-risk individuals (such as patients with chronic lung disease) should be cautioned about the risks of exposure to *Legionella* in or around pools and hot tubs.

Drinking water quality [4]

Legionella is considered as a high health hazard when encountered in water supplies. Water safety plans are thought to be comprehensive risk assessment and risk management approaches and include all steps in the supply of water from catchment to consumer use. Because *Legionella* contamination in structures such as cooling towers and the hot water systems of large buildings is a particular risk, specific water safety plans should be developed, that incorporate control measures for *Legionella* species.

Accumulation of sludge, scale, rust, algae or slime deposits in water distribution systems and stagnant water supports the growth of *Legionella* species. It is easier to detect *Legionella* from swab samples than from flowing water because it survives and grows in biofilms and sediments. This is also the reason why disinfection strategies are designed to minimize biofilm growth and to control temperature. The following should be taken into consideration:

- Water temperatures should be kept outside the range of 25–50 °C.
- Where temperatures in hot or cold water distribution systems cannot be maintained outside the range of 25–50 °C, greater attention should be paid to disinfection and strategies aimed at limiting the development of biofilms
- Systems should be kept clean and flowing.
- Care should also be taken to select plumbing materials that do not support microbial growth and the development of biofilms.

Sanitation on ships [5]

This document draws attention to the relative high *Legionella* infection risk rate on ships, revealed by reviews of reports and papers. There have been hundreds of cases on passenger ships as well as cargo ships. Factors contributing to outbreaks included contaminated water supply, spa pools and air-conditioning system on ships. The document refers to general guidelines already published on reducing the risk of Legionnaires' disease in spas and buildings, which are also applicable to ships. Specific guidelines on the maintenance of ship water supplies and spas have been published by the Centres for Disease Control and Prevention (CDC) of the United States of America.

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4.1.2. International Organisation for Standardisation (ISO)

Introduction

The International Organisation for Standardisation (ISO) is an international standard-setting body composed of representatives from national standards organisations. It is made up of 161 members and has its Central Secretariat in Geneva (Switzerland). ISO is a non-governmental organisation that forms a bridge between the public and private sectors.

The ISO Technical Committees (TC), Subcommittees (SC) and Working Groups (WG) develop International Standards. Standardisation follows a six-step process:

Stage 1: Proposal stage
Stage 2: Preparatory stage
Stage 3: Committee stage
Stage 4: Enquiry stage

Stage 5: Approval stage
Stage 6: Publication stage

The standards are the result of an agreement between the member bodies of ISO. ISO documents are copyrighted and most of the standards must be purchased.

ISO Standards

Regarding *Legionella*, the ISO and in particular its Working Group 2: 'Legionella' of the SubCommittee 4: 'Microbiological methods' and Technical Committee 147: 'Water Quality', has developed the International Standard ISO 11731 (1998) ('Water quality – Detection and enumeration of Legionella'). This standard describes a culture method for the isolation of *Legionella* organisms and estimation of their numbers in environmental samples. This method is applicable to all kinds of environmental samples including potable, industrial and natural waters and associated materials such as sediments, deposits and slime. This culture method is very complex and time consuming because it is applicable for all kinds of water including waste water. For this reason an alternative method was developed in 2004: ISO 11731 – 2 ('Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts'). It describes a monitoring method for the isolation and enumeration of *Legionella* organisms in water intended for human use (e.g. hot and cold tapwater, water used for washing), for human consumption and for treated bathing waters (e.g. swimming pools). It is especially suitable for water with suspected low numbers of *Legionella*. As the growth of *Legionella* may be inhibited by overgrowth of other bacterial colonies on the membrane, the method is only suitable for water containing a low bacterial load.

4.2. Annex 2 - European Policies

4.2.1. The European Union (EU) Legislation

Directives

Directive 2000/54/EC of the European Parliament and the Council dated 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work [1] categorises *Legionella pneumophila* and other *Legionella* species capable of causing human diseases as a Group 2 pathogen. A Group 2 biological agent is one that can cause human disease and might be a hazard to workers, while it is unlikely to spread to the community and where there is usually an effective prophylaxis or treatment. There is no other distinct provision concerning *Legionella* species. Directive 2000/54/EC refers to the Framework Directive [2], which demands that the employer carries out risk assessment and takes adequate measures to protect workers.

Two Directives concerning drinking and bathing water are associated with *Legionella* in some EU countries:

- Drinking water directive 98/83/EC (on the quality of water intended for human consumption) [3] states that drinking water should be free from any microorganisms and parasites and from any substances which, in large numbers or concentrations, constitute a potential danger to human health.
    - *Legionella* is not specifically mentioned but EU Member States may add this and other parameters to their monitoring checklist, if they deem it appropriate.
- Bathing water directive 2006/7/EC [4] concerns the management of bathing water quality and is repealing Directive 76/160/EEC. This directive lays down provisions for:

  (a) the monitoring and classification of bathing water quality;

  (b) the management of bathing water quality; and

  (c) the provision of information to the public on bathing water quality.

  The directive does not specifically mention Legionella but some EU Member States have included this parameter in its transposition to national law.

Important: In section 4 of this report on European Union Member States, the national transpositions of the drinking water and bathing water directives are mentioned only if Legionella is specifically mentioned in national law.

With respect to the building industry, specific requirements in Annex I.A – Air Quality-4 of the Interpretative document [5] concerning Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (Annex I: Essential requirements, Hygiene, health and the environment, Pollution or poisoning of the water or soil) stipulate that the risk of *Legionella* infection in buildings must be minimised. It includes provisions regarding

- the prevention of *Legionella* bacteria and other harmful microorganisms in aerosols
- the design of systems to facilitate testing, cleaning and chemical treatment
- the design of systems to maintain throughout their function temperatures which are not conducive to the growth of *Legionella*
- the design of systems to avoid water stagnation.

Measures include temperature control, minimisation of aerosols and static water, stratification minimisation, avoidance of materials that can provide nutrients, and design of systems that facilitate cleaning.

Legionellosis is not contained in the annexes of the European schedule of occupational diseases [12], nor is it mentioned in the upcoming revision.

4.2.2. The European Working Group for Legionella Infections (EWGLI) and the European Centre for Disease Prevention and Control (ECDC)

The European Surveillance Scheme for Travel-Associated Legionnaires' Disease (EWGLINET) was established in 1987 by members of the European Working Group for Legionella Infections (EWGLI). Collaborators are normally national or regional representatives from public health and microbiology institutes in each country. EWGLINET has issued European guidelines for the control and prevention of travel-associated Legionnaires' disease. These recommendations facilitate standardised rapid control and prevention measures in all participant countries to safeguard tourists from infection. In 2010, EWGLINET has been renamed as the European Legionnaires' Disease Surveillance Network (ELDSNet) and transferred to the European Centre for Disease Prevention and Control (ECDC).The dedicated ELDSNet website [6] is a European resource providing information on *Legionella* infections for health professionals, tour operators and members of the public [7]. The guidelines issued by EWGLI [8] offer a standardised approach to procedures for preventing and detecting *Legionella* infections associated with travel and aim to further harmonise these procedures among Member States. While it deals mainly with the investigation and reporting of travel-associated Legionella diseases, in point 27 it identifies the employer as the responsible person to carry out risk assessment, control and communication 'where the risk from their undertaking is to their employees or to others'. In Appendix 2, a 'Check List for Hotels and other Accommodation Sites' is published. In Supplement 1, Part A there is a text on 'Technical guidelines for the control and prevention of Legionella in water systems', which is mainly based on the revised UK guidelines published in 2000. Supplement 1, Part B, 'Treatment methods for different water systems', provides brief information on the use of biocides for the regular control of cooling systems. It also describes the use of heat, chlorine, chlorine dioxide and copper/silver ionisation for the disinfection and control of growth of *Legionella* bacteria in hot water systems and considers some alternatives. Cold water systems and spas are also considered. There is no distinct category for occupational *Legionella* diseases in the EWGLI data collection [9].

A recent survey by EWGLI reviews legislation on wet cooling systems in European countries. The authors believe that a register of wet cooling systems can speed up the investigation process considerably, in case of an outbreak of legionellosis. They also believe that the European Centre for Disease Prevention and Control (ECDC) should take the initiative to propose European Community (EC) regulations for all Member States [10].

4.2.3. European projects

In 2009 the European Commission launched a LIFE+ programme named LEGIOTEX aiming at reducing and eventually eliminating the *Legionella* problem using biotechnology. It involves the development of a filter capable of inhibiting the growth and proliferation of bacteria belonging to the *Legionella pneumophila* family in water-based climate control equipment at risk of becoming a source for legionnaires' disease outbreaks in large public and industrial facilities. The programme is headed by the Spanish Association for Research in the Textile Industry (Asociación de Investigación de la Industria Textil). It plans to eventually develop a European legislation proposal based on the validation and demonstration of the new eradication technique for *Legionella pneumophila* [11].

4.2.4. European Committee for Standardisation (CEN)

The standard ISO 11731-2: 2004 has been adopted as an EU standard, Standard EN ISO 11731-2: 2008 'Water quality – detection and enumeration of Legionella' by the CEN Technical Committee CEN/TC 230 'Water Analysis'. The text of ISO 11731-2: 2008 was approved by CEN without any modification. All members of CEN were required to give this European standard the status of a national standard by September 2008, and to withdraw conflicting older standards.

Technical Committee CEN/TC 216: 'Chemical disinfectants and antiseptics' has developed a standard that is currently undergoing approval: prEN 13623: 2008 'Chemical disinfectants and antiseptics – Quantitative suspension test for the evaluation of bactericidal activity against *Legionella pneumophila* of chemical disinfectants for aqueous systems -Test method and requirements (phase 2, step 1)'.

This European standard applies to products used to treat water in order to kill *Legionella pneumophila*. It specifies a test method and the minimum requirements for bactericidal activity of chemical disinfectant products intended to be used for treatment in aqueous systems against *Legionella pneumophila* that form a homogeneous, physically stable preparation when diluted with buffered ferrous hard water or hard water. This method is suitable for treating water used in cooling towers and water for general purposes such as spa baths, pools, showers and other uses. The method is not suitable for electro-chemical disinfection.

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4.3. Annex 3 - European Union Member States

4.3.1. Austria

Introduction

Legionella infections were reported voluntarily in Austria up to 2001, when notification became compulsory. In 2007, 108 cases of Legionnaires' disease, including 11 fatalities (fatality rate: 10.19%), were reported to the National Reference Centre for Legionella Infections (NRLI). The sources of infection could be identified in 66 cases (61%). According to the NRLI the most likely sources of infection were the water supply systems of hospitals, hotels and campsites. Cooling towers were also sources of *Legionella* growth. Ninety-one cases of *Legionella* diseases were reported in 2008 [1].

Legislation

Infection

The Austrian Epidemic Act, BGBl. No. 186/1950, regulates notification of disease outbreaks in humans. The act was amended in 2008 (BGBL. Nr. 76/2008) and now covers the detection of infection sources as well as disease reporting [2].

Drinking water

Drinking water is defined as food in Austria and is therefore subject to stringent national and international quality criteria [3]. The quality of drinking water is regulated by the Drinking Water Act (Trinkwasserverordnung BGBl. Nr. 304/2001), which implements the Drinking Water Directive 98/83/EC into Austrian national legislation. Section 3 clause 1 of the act defines the requirements for drinking water quality as follows:

- Drinking water must be suitable for human consumption or use without any damage to human health. This is realised if water does not contain microorganisms, parasites and substances in concentrations that can damage or hurt human health.

Section 4 of the act stipulates that quality checking of the water has to be done at the tap. This ensures that problems caused by the supply system such as quality of the pipes, valves, sealant and pumps, as well as stagnation of water in pipes and water temperature will be covered by the assessment.

Section 5 of the act regulates the responsibilities of planners, manufacturers and operators of water supply systems. The responsibility is defined as follows:

- The operator has to set up the water supply system according to the state of the art, to maintain the system appropriately and to take measures to prevent negative influences that affect the water quality. The water supply system has to be professionally maintained by trained personnel.

The act lays down limit values for substances harmful to health and pathogens, and defines the scope and frequency of testing. It stipulates that drinking water should contain no pathogenic germs in concentrations that might be harmful for human health. The concentration shall be set in a way that no harmful effects can be expected to result from lifelong intake. The act does not specifically mention *Legionella*.

The Drinking Water Act is accompanied by Austrian standards.

Bathing water

The Austrian National Act on Hygiene in Public Baths (swimming pools and spas) aims at preventing the spread of waterborne communicable diseases. The act came into force in 1976 (Bäderhygienegesetz BHygG – Bundesgesetz über Hygiene in Bädern, Sauna-Anlagen, Warmluft-

und Dampfbädern, Kleinbadeteichen und über die Wasserqualität von Badestellen) and was followed by the Ordinance for Bathing Water Hygiene (Bäderhygieneverordnung BHygV) in 1978. The Act and the Ordinance regulate the hygiene of public baths and saunas: the water quality, the preparation plant for bathing water, the management and the water checks [4].

Chapter III of the Act deals with the hygiene regulations of bathing water and defines it in section 12, clause 1 as follows:

- Water that is fed into pools must be of drinking water quality regarding hygiene, chemical substances must be in concentrations so that the health of bathers and visitors to the sauna or steam baths is not at risk.

The Act also regulates the hygiene of secondary equipment such as toilets, saunas, steam baths and showers. Showers are particularly susceptible to *Legionella* infections. Section 12 clause 4 of the act says that 'Water for washing and showers must be of drinking water quality' [5].

The Ordinance for Hygiene in Public Baths regulates the requirements for water quality in pools as well as official inspections. The Ordinance provides that *Legionella* species must not be verifiable in 100 ml water (fill-up water with a temperature of more than 20 °C or pool water with a temperature more than 30 °C (section 2 clause 2d and section 31b)) [6]. Regarding aerosol-producing equipment (such as showers, steam baths and aerators), the Ordinance stipulates *Legionella* checks and regulates the quality of water that is used to fill the pools [7].

Occupational Health and Safety

The Workers' Health and Safety Act (ArbeitnehmerInnenschutzgesetz, ASchG) regulates the health and safety of workers in Austria. According to this act employers are responsible for ensuring that their workers work in accordance with health and safety regulations (avoiding risks and hazards, considering the state of the art).

Section 27 clause 1 stipulates that employers have to provide appropriate washing places with hygienic running water and if possible warm water, cleaning agents and enough towels for drying [8].

The Council Directive 2000/54/EC was transposed into Austrian law by the Ordinance on the Protection of Employees against Hazards caused by Biological Agents (Verordnung biologische Arbeitsstoffe (VbA BGBl. II Nr. 237/1998)). The Ordinance was adopted by the Ministry for Labour, Health and Social Affairs in 1998. It stipulates measures to avoid risks and dangers for workers resulting from activities with biological agents such as equipment, hygiene, handling of agents, reduction of exposure and vaccination of workers. *Legionella* is classified according to the Ordinance as group 2.

Standards

The platform for the preparation of Austrian Standards (ÖNORMs) is the Austrian Standards Institute (ON). It is a non-profit public service.

Drinking water and public bath water

ÖNORM B 5019 ('Hygienic aspects of planning, construction, operation, maintenance, surveillance and rehabilitation of central heating installations for drinking water') regulates how water supply systems have to be built to ensure water quality. The standard draws particular attention to the prevention of *Legionella* growth and stipulates the design of different kinds of hot water supply systems. It covers dimensions, the required material, the water temperature and the insulation of the pipe system. Compliance with the standard prevents the growth of *Legionella*. The ÖNORM also regulates the planning, operation, checking and maintenance of the water supply system.

The fundamental points of the ÖNORM are [9]:

- Minimum water temperature of 60 °C when water enters the hot water distribution system
- Minimum water temperature of 55 °C for water in the water circulation system

- Optimum insulation of the cold water system; separated systems of hot and cold water are preferred
- Thermal disinfection at 70 °C must be possible
- Regular checks.

Other relevant ÖNORMS regarding the prevention of *Legionella* infections are:

- ÖNORM M 6222-1 Requirements for the characteristics of bath water in whirlpools – operation, maintenance and inspection (Anforderungen an die Beschaffenheit des Badewassers in Whirlwannen – Betrieb, Wartung und Überprüfung).
- ÖNORM 6216 Swimming pools – requirements for pool hydraulics and water treatment (Schwimm- und Badebecken – Anforderungen an die Beckenhydraulik und die Wasseraufbereitung).

These standards are available for purchase and can be ordered from the Austrian Standards Institute [10].

Policies

The Federal Ministry of Economy, Family and Youth (Bundesministerium für Wirtschaft, Familie und Jugend, BMWFJ) is responsible for safety and health legislation in Austria and publishes the regulations for the control of biological agents.

The Austrian Agency for Health and Food Safety (Österreichische Agentur für Gesundheit und Ernährungssicherheit, AGES) carries out several tasks relating to nutrition for the Austrian government. The organisation involves 18 federal institutes and departments with various areas of expertise including food inspection, bacteriology and serology, veterinary medicine and agriculture [11]. One of the departments is responsible for human medicine and infection control. The AGES' health professionals are in charge of preventing and combating infectious diseases. One of its divisions deals with *Legionella*: the National Reference Centre for Legionella Infections (NRLI). It is a member of EWGLI and is involved in the European Surveillance Scheme for Travel Associated Legionnaires' Disease (EWGLINET).

The Austrian accident insurance body AUVA ran a three-year project to evaluate the *Legionella* contamination of waters at the workplace. Companies could participate voluntarily. A basic inspection of their water systems was carried out and in case of *Legionella* contamination AUVA provided advice [12].

Information, guidelines

The Austrian Association for Gas and Water (Österreichische Vereinigung für das Gas und Wasserfach, ÖVGW) provides different leaflets with relevant information for drinking water supply.

The following guidelines are relevant for *Legionella* prevention. The guidelines are available for purchase:

- W 85 Betriebs- und Wartungshandbuch für Trinkwasserversorgungs-Unternehmen; Grundsätze für die Erstellung und Führung von Betriebs- und Wartungshandbüchern in Trinkwasserversorgungs-Unternehmen (Operation manual for water supply companies) [13].

This manual, aimed at drinking water suppliers, describes how to draw up an operation and maintenance guide for drinking water. Other guidelines are:

- W 54 Überwachung zentraler Trinkwasserversorgungsanlagen unter besonderer Berücksichtigung der hygienischen Verhältnisse – Inspection of drinking water supply systems with special regard to hygiene.
- W 55 Hygienische Rohrnetzwartung – Hygienic maintenance of the mains (pipe system).

The city of Vienna's Working Team for Hygiene and Health Care facilities (Arbeitskreis für Hygiene in Gesundheitseinrichtungen des Magistrats der Stadt Wien) has published various information leaflets concerning water inspections and checks, which are relevant to *Legionella*:

- MA 15 – no. 8, Überprüfung von Trinkwasser in Krankenanstalten und Pflegeheimen auf Verkeimung mit möglichen Krankheitserregern – Information about the inspection of drinking water in healthcare institutions and nursing homes for pathogenic germs, especially *Legionella* and pseudomonas [14].
- MA 15 – no. 22, Vorbereitung und Durchführung von Entnahmen von Wasserproben zur Untersuchung auf Legionellen. Preparation and technique of water samples for *Legionella* analyses. According to this leaflet the water systems in healthcare institutions and nursing homes have to be inspected once a year (annually) [15].
- MA 15 – no. 4, Gesundheitsdienst der Stadt Wien, 2007, Intervalle für Krankenhaushygienische Untersuchungen (time intervals for hygiene inspections in healthcare facilities) [16].

The Austrian Agency for Health and Food Safety (AGES) provides information about *Legionella* on its webpage and has published two guidelines and one brochure.

- Kontrolle und Prävention der reiseassoziierten Legionärskrankheit (Control and prevention of travel-associated Legionnaires disease) [17]. This guideline describes prevention and control strategies regarding travel-associated Legionnaires' disease. Measures to prevent *Legionella* contamination in water supply systems are presented to minimise *Legionella* infections in accommodation facilities.
- Kontrolle und Prävention der reiseassoziierten Legionärskrankheit – Maßnahmen für Beherbergungsbetreiber (Control and prevention of travel-associated Legionnaires' disease – requirements for hostel operators (managers)) [18]. This guideline provides information for hostel operators on how to achieve a *Legionella*-free environment. It contains information about risk assessment, technical inspection of the water supply system, and guideline on how to get water samples and a checklist.

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4.3.2. Belgium

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for Belgium is 22 (0.2) for 1997, 61 (0.6) for 1998, 195 (1.9) for 1999, 67 (0.7) for 2000, 109 (1.1) for 2001, 119 (1.2) for 2002, 96 (0.9) for 2003, 162 (1.6) for 2004, 175 (1.7) for 2005 and 220 (2.1) for 2006 [1].

Legislation

Occupation health and safety in Belgium is addressed by the 'Law for the wellbeing of workers at the workplace' (Loi 1996 relative au bien-être des travailleurs lors de l'exécution de leur travail).

Royal decree AR/1996 relates to the protection of workers against exposure to biological agents.

Workers exposed to biological agents have to undergo medical examination annually or even more frequently, depending on the advice of a consultant/occupational physician. The occupational health and safety committees in the workplaces have to approve this examination.

The Belgian List for occupational diseases (last updated in 2004 AR 27.12.2004 – MB du 09.02.2005) includes at point 1.4 occupational infectious and parasitic diseases, but no specific reference is made to *Legionella* or legionellosis.

In 1996 the Ministry of the Flemish Community declared legionellosis a disease for which notification was compulsory (a notifiable disease). Legionellosis is part of the B group of diseases that have to be reported to hygiene inspectorates by any healthcare unit or laboratory within 48 hours of diagnosis. This provision does not apply to the Wallonia and Brussels regions.

There is legislation requiring the registration of wet cooling systems at a regional level, in Wallonia and Flanders.

The legislation on the registration of wet cooling systems in Belgium is:

- In Flanders, a Regional Regulation for the prevention of legionellosis in public places, issued by the Ministry for Public Health in 2007. Microbiological monitoring has to be carried out at least twice a year.
- In Wallonia, a Regional Regulation contained in the requirements for building permission, issued by the Ministry for the Environment in 2005. Microbiological monitoring has to be carried out every two months and, if the result is negative, every three months.

Royal decree AR 27-03-1998 on the policy for the wellbeing of workers (Arrêté royal relatif à la politique du bien-être des travailleurs lors de l'exécution de leur travail) specifies that organisations should draw up and implement their own policy relating to occupational health and safety and the wellbeing of their employees. The organisational policy has to comply with the National Strategy for Wellbeing at Work, as well as with all applicable legislation.

The employer's managerial team has to plan the objectives, the means and the methods to achieve them, the duties and powers of all personnel. The employer is also responsible for the implementation of the policy and has to evaluate the current policy on a regular basis and against well-defined criteria that allow for the improvement of the company's OSH performance.

The National Strategy for Wellbeing at Work 2008–2012 underlines the importance of efforts to mitigate risk levels in the workplace and to create a safer and more comfortable working environment.

Standards

Belgium has adopted the International Standard on Water quality – detection and enumeration of Legionella, as NBN EN ISO 11731/2008.

Belgium has also adopted in its national standardisation system the EN standard 'Water quality – Enumeration of culturable microorganisms – Colony count by inoculation in a nutrient agar culture medium' as NBN EN ISO 6222:2004, intended for the measurement of operational efficiency of the treatment process of public drinking water, and also applicable to water in closed containers. EN ISO 6222:2004 deals with microorganisms in general (including *Legionella*) while EN ISO 11731 was published later and is specific to *Legionella*.

Standard NBN EN 806/2002 – 'Specifications for installations inside buildings conveying water for human consumption' is also enforced in Belgium. Part 2 of the standard mentions that: 'in respect to the prevention of growth of *Legionella* bacteria national or local regulations shall apply'.

Policies

In Belgium several institutions contribute to the control of exposure to *Legionella*: the Federal Public Service for Employment, Work and Social Solidarity, for occupational health and safety matters; the Superior Council for Hygiene, for public health matters; and the Environmental authority. All of them are under the coordination of the Ministry of Social Affairs, Public Health and Environment.

In the Federal Public Service for Employment, Work and Social Solidarity (Service public fédéral Emploi, Travail et Concertation Sociale) the Division for Regional Control of Occupational Health and

Safety is in charge of the surveillance and the compliance with the law for OSH in enterprises (except for the SEVESO aspects).

Belgium is a member of EWGLI and the national collaborators are: the Epidemiology Unit of the Scientific Institute of Public Health, Brussels; the Microbiology Department, Erasme Hospital of the Free University of Brussels; the Microbiology Department of the Hospital for Hygiene – Clinical Biology, Academy Hospital - Vrije University Brussels.

Belgium has two reference laboratories for *Legionella*, both in Brussels: the AZ-VUB Labo Microbiologie Brussels and the Hôpital Erasme Labo Microbiologie Brussels.

The Superior Council of Hygiene produced two reports concerning *Legionella* in 1998. The situation has not changed significantly since then. The reports underline that the disinfection of pipelines, whether chemical or thermal, is not an effective solution. Such a solution is not even technically possible in practice (e.g. in pipes with dead ends) and if the disinfection is not carried out by a specialist it can do more harm than good (e.g. by enhancing corrosion and therefore creating a layer that is even more favourable to the development of *Legionella*).

The same Council has recommended the setting up of a technical working group that would:

1. Draw up technical norms for the periodic maintenance of hot water systems;
2. Determine the frequency of the controls and inspections for different types of institutions, depending on the specific risk level and technical norms in place for inspections and sampling;
3. Draw up technical norms for the measures to be taken if the limits for *Legionella* are exceeded;
4. Establish the conditions for the accreditation of bodies, institutions and enterprises in charge of periodical sampling and the supervision of remediation measures.

References

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[2] Conseil Supérieur d'Hygiène, section V (C.S.H.: 4870) – Avis du 14/06/2000, approuvé le 29/09/2000, relatif aux dangers de et aux measures préventives contre une contamination par Legionella en Belgique

[3] Groupe de travail Legionella (No CSH: 7509) – Edition janvier 2002 – Recommandations pour la prevention des infections a Legionella dans les etablissements de soins

[4] M.B. 1.10.1996 – Arrêté royal du 4 août 1996 concernant la protection des travailleurs contre les risques liés à l'exposition à des agents biologiques au travail

[5] M.B. 19.9.1997 – Arrêté royal du 17 juin 1997 concernant la signalisation de sécurité et de santé au travail

[6] M.B. 7.10.1999 – Arrêté royal du 29 avril 1999 modifiant l'arrêté royal du 4 août 1996

[7] M.B.18.9.2002 – Arrêté royal du 28 août 2002 désignant les fonctionnaires chargés de surveiller le respect de la loi du 4 août 1996 relative au bien-être des travailleurs lors de l'exécution de leur travail et de ses arrêtés d'exécution

[8] M.B. 16.6.2003 – Arrêté royal du 28 mai 2003 relatif à la surveillance de la santé des travailleurs

[9] Ministère de la Communauté Flamande – Voorkom Legionellose

[10] NBN EN ISO 11731-2:2008 – Qualité de l'eau – Recherche et dénombrement des Legionella – Partie 2: Méthode par filtration directe sur membrane pour les eaux à faible teneur en bactéries (ISO 11731-2:2004) = EN ISO 11731-2:2008

[11] NBN EN ISO 6222:1999 – Qualité de l'eau – Dénombrement des micro-organismes revivifiables – Comptage des colonies par ensemencement dans un milieu de culture nutritif gélosé (ISO 6222:1999) = EN ISO 6222:1999

[12] NBN EN 806-1:2000 – Spécifications techniques relatives aux installations pour l'eau destinée à la consommation humaine à l'intérieur des bâtiments – Partie 1: Généralités = EN 806-1:2000

[13] NBN EN 806-1/A1:2001 – Spécifications techniques relatives aux installations pour l'eau destinée à la consommation humaine à l'intérieur des bâtiments – Partie 1: Généralités = EN 806-1:2000/A1:2001

[14] NBN EN 806-2:2005 – Spécifications techniques relatives aux installations pour l'eau destinée à la consommation humaine à l'intérieur des bâtiments – Partie 2: Conception = EN 806-2:2005

[15] NBN EN 806-3:2006 – Spécifications techniques relatives aux installations d'eau destinée à la consommation humaine à l'intérieur des bâtiments – Partie 3: Calculations des diamètres intérieurs – Méthode simplifiée = EN 806-3:2006

4.3.3. Bulgaria

Introduction

Up to now only three cases of Legionnaires' disease have been confirmed and reported in Bulgaria (in 2003, 2004 and 2005). The 2004 case was a Bulgarian patient, and it was considered to be a community-acquired case. The other two cases were associated with a hotel. The first travel-associated case, reported in 2003, was a foreign citizen who stayed in a Bulgarian hotel. He was part of a cluster of three (all foreign citizens, one diagnosed in Bulgaria, two abroad). The second travel-associated case, reported in 2005, was a Bulgarian patient who stayed in a foreign hotel but was not part of a cluster [1].

Policies

Since 2002, Bulgaria has been a member of the European Working Group for Legionella Infections [2], and since July 2005 legionellosis has been a notifiable disease in the country [3].

The public health significance of Legionnaires' disease continues to be underestimated in Bulgaria. With few exceptions, there are no relevant diagnostic tests, and no requests for *Legionella* identification are made by physicians. *Legionella* infections are still underdiagnosed and underreported. The planned establishment of a laboratory for the surveillance of legionellosis is expected to solve these problems.

References

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2. http://www.ewgli.org/
3. Regulation No 21/2005 for notification, registration and reporting of communicable diseases (in Bulgarian). Ministry of Health, Official Bulletin 15, 2005.

4.3.4. Cyprus

Introduction

According to EWGLINET, 31 cases of *Legionella* infections were associated with travelling in Cyprus from 1991 to 2008 [1]

Legislation

Occupational health and safety regulations (laws in Cyprus are called regulations) concerning biological agents demand a written risk assessment for activities that may involve the risk of exposure

in biological agents. *Legionella pneumophila* is included in Annex 1 of Regulation KDP 144/2001 and is classified in Group 2. This regulation transposes directive 2000/54/EC.

Regulation KDP 530/2007 deals with occupational disease notification. Although *Legionella* is not explicitly mentioned as an occupational disease in the above regulation, it is considered in practice as such.

The old colonial law of 1932 and its modifications deal with quarantine. Annex 1 of this law contains a list of infectious diseases. *Legionella* is not explicitly mentioned.

Policies

Cyprus has been a member of EWGLINET since 2004, but only became a signatory of the European guidelines.It is estimated that, by the end of 2009, Cyprus will be fully integrated in the network.

In Cyprus the Department of Labour Inspection of the Ministry of Labour and Social Insurance and the Group for Epidemiological Surveillance of Infectious Diseases of the Ministry of Health are responsible for the management of problems caused by *Legionella*.

Inspectors from the labour inspectorate examine workplaces to check whether the employers are taking all the necessary health measures, including those focused on *Legionella*. Part of this is that employers who have big air-conditioning systems or similar facilities must apply a programme for control and prevention of *Legionella*, based on OSH legislation. As mentioned above, Legionnaires' disease is considered an occupational disease in Cyprus.

In January–February 2009 the Department of Labour Inspection organised an inspection campaign in public and private hospitals concerning *Legionella*. A similar campaign is scheduled for June 2009, so as to see whether progress has been made. The labour inspectorate has also published a pamphlet entitled: 'Legionnaire's Disease. General Principles and guidelines for the assessment and encounter of the risk', directed at employers, explaining their legal duties in preventing *Legionella*. The pamphlet is available on the website of the Ministry of Labour [2].

According to OSH legislation the person responsible for the notification of a disease is:

- an employer who believes, suspects or is in the possession of a medical certificate stating that one of his employees is ill
- a self-employed person who believes or suspects or has been informed by a registered doctor that he or she is infected by the disease
- a doctor who diagnoses or believes or suspects that an employee suffers from the disease
- generally, any public or private organisation which in the framework of its activities can collect data for occupational diseases.

Occupational diseases are reported by using a disease notification form directed to an authorised inspector in the patient's working district or to the consulting occupational physician of the Ministry of Labour and Social Insurance.

The Network for Surveillance and Control of Communicable Diseases of the Medical and Public Health Services Department, which belongs to the Ministry of Health, deals with the issue of *Legionella* in Cyprus from a medical point of view. This network consists of physicians from the public health system, nurses, health inspectors and medical laboratory technologists. The group collaborates with European and international organisations, as well as controlling, managing and coordinating the committees on infectious diseases that have been set up in state hospitals. In all such hospitals, risk assessment for *Legionella* disease is carried out and reviewed every two or three years.

In the reporting system for notifiable diseases, the data collected on 44 notifiable infectious diseases, including legionellosis, are recorded and analysed according to the existent legislation (the 1932 Law and its modifications concerning quarantine). According to this law, when a medical officer establishes that a person is infected, the officer must fill in the report statement and forward it to the chief medical officer of the district. The medical officer is responsible for taking all necessary measures, in cooperation with the health inspector, to ensure public health and to forward the report

statement to the national medical and public health services. In cases where a person is suffering from a specific disease for which there is a high risk to public health, then the statement should be sent to the directors of both the medical and public health services within 24 hours.

The Cyprus General Laboratory carries out the analysis for the detection of the *Legionella* bacterium.

References and further reading

[1] http://www.ewgli.org/data/data_tables/year_onset_country_travel.asp

[2] http://www.moh.gov.cy/MOH/mphs/phs.nsf/All/A6D5C5E10BB9639DC2256F800039CDBC?OpenDocument

[3] http://www.mlsi.gov.cy/mlsi/dli/dli.nsf/dmlpublications_New_gr?openform&p=1&t=f&e=

[4] http://www.cysha.org.cy/GR/Documents/interesting_articles/downloads/article_004.pdf

4.3.5. Czech Republic

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for the Czech Republic is 3 (0.0) for 1997, 10 (0.1) for 1998, 11 (0.1) for 1999, 13 (0.1) for 2000, 10 (0.1) for 2001, 10 (0.1) for 2002, 8 (0.1) for 2003, 9 (0.1) for 2004, 9 (0.1) for 2005 and 15 (0.1) for 2006 [1].

Legislation

According to Czech legislation [2] *Legionella* is a biological agent that can cause damage to human health, including the cases of occupational exposure. The employer has to plan and implement effective protective and preventive control measures for employees exposed to biological agents. Medical examination of exposed workers must comply with national regulations.

Workers have to undergo specific medical examinations before starting work. After being hired they are obliged to undertake a periodical medical examination.

Health service providers (hospitals, laboratories, etc.) are obliged to notify authorities immediately if a case of Legionellosis is diagnosed.

The control of biological agents is also addressed by

- Decree No. 252 /2004 (as amended) specifying hygienic requirements for drinking and hot water and extent and frequency of monitoring for quality of drinking water [3]
- Decree No.135 / 2004 specifying hygienic requirements for natural bathing waters, swimming-pools, and hygienic limits of sand in children sandpits [4]
- Methodology issued by the Chief Public Health Officer (Ministry of Health), 2004 - Assessing Operational Regulations of Therapeutic and Rehabilitation Pools in Healthcare Facilities [5].

In 2000 the Czech Ministry of Health issued a methodology for the programme of legionellosis surveillance (Metodicky navod k zajisteni programu surveillance legioneloz), which was later (2008) converted to the Decree of the Ministry of Health [6].

The Czech Republic has no legal requirements for registering cooling towers.

Standards

The Czech Republic has adopted the International Standard on Water quality – detection and enumeration of *Legionella*, as CSN ISO 11731/2002. The standard describes a monitoring method for

the isolation and enumeration of *Legionella* organisms in water intended for human use (e.g. hot and cold water used for washing), for human consumption and for treated bathing water (e.g. swimming pools). The method is suitable only for water containing low numbers of bacterial colonies.

The Czech Republic has also adopted in its national standardisation system the standard entitled 'Water quality – Enumeration of culturable microorganisms – colony count by inoculation in a nutrient agar culture medium', as CSN ISO 6222:2000 intended for the measurement of operational efficiency of the treatment process of public drinking water, applicable also to water in closed containers. EN ISO 6222:2004 is for microorganisms in general, including *Legionella*, while the EN ISO 11731 is for *Legionella*.

Standard EN 806/2002, 'Specifications for installations inside buildings conveying water for human consumption' is also enforced in the Czech Republic as CSN EN 806-2. Part 2 of this standard mentions that: 'in respect to the prevention of growth of *Legionella* bacteria national or local regulations shall apply'.

Policies

The Czech Republic is a member of EWGLI and a signatory to the European Guidelines, the national collaborator being the Public Health Institute Ostrava, National Legionella Reference Laboratory.

The Czech Republic has harmonised its legislation with the EU Directives and has legal requirements that address *Legionella* as a specific matter or as part of the biological agents group. As an occupational issue, the departments of Industrial Hygiene and the Centre of Industrial Hygiene and Occupational Diseases, which were integrated into the Regional Public Health Authorities, including specialized laboratories of Regional Public Health Institutes, controlled exposure to *Legionella*.

There are about 75 regional and district departments of industrial hygiene throughout the country. These departments carry out supervision and control activities in workplaces and also provide objective information on the hygiene status of workplaces for clinical use. An occupational disease or contamination cannot be notified unless it is supported by an appropriate hygienist's report. Health reforms since the early 2000s have strengthened regional health policy and local health authorities have the competence to register cases of legionellosis.

The country carries out research into *Legionella* monitoring and participates in the common European effort to control *Legionella* infections.

References

[1] http://ec.europa.eu/health/ph_information/dissemination/echi/docs/legionellosis_en.pdf

[2] Ministry of Health - Decree of No. 473/2008 on surveillance system of selected infectious diseases.

[3] Ministry of Health – Decree of No. 252 / 2004 specifying hygienic requirements for drinking and hot water and extent and frequency of monitoring for quality of drinking water

[4] Ministry of Health – Decree of No.135 / 2004 specifying hygienic requirements for natural bathing waters, swimming-pools, and hygienic limits of sand in children sandpits

[5] Methodical Measure of the Chief Public Health Officer, 2004 – Assessing of Operational Regulations of Therapeutic and Rehabilitation Pools in Healthcare Facilities

[6] Ministerstvo Zdravotnictvi Praha – Metodicky navod k zajisteni programu surveillance legioneloz, 2000

4.3.6. Denmark

Introduction

According to the Health and Consumers Directorate-General of the European Commission, the number of cases of legionellosis (and the incidence per 100,000 of population) for Denmark is 123 (2.3) for 1997, 92 (1.7) for 1998, 93 (1.8) for 1999, 92 (1.7) for 2000, 103 (1.9) for 2001, 97 (1.8) for 2002, 87 (1.6) for 2003, 98 (1.8) for 2004, 115 (2.1) for 2005 and 124 (2.3) for 2006 [1].

Legislation

There are no regulations in Denmark dealing directly with *Legionella* prevention and control. Some legislation has indirect influence, e.g. legislation on swimming pools, and the overarching legislation is a transposition of the EU Biological Agents Directive.

Policies

Denmark is a member of EWGLI and the national collaborator is the Statens Serum Institut [2, 3].

Occupational health and safety legislation in Denmark is administered by the Danish Working Environment Authority (Arbejdstilsynet) [4], an agency under the auspices of the Ministry of Employment. Prevention and control of infectious diseases among members of the public is overseen by the Statens Serum Institut under the Danish Ministry of the Interior and Health, and its duties are partly integrated into the Danish national health service.

A report published in 2004 [5] gave an overview of assessment of *Legionella* risk in Denmark, covering hot water systems, bathing water, drinking water, etc. It highlighted the following water systems as high risk:

- Poorly maintained spa-pools
- Hot water supplies – particularly showers – operating at too low temperatures
- Poorly maintained ice cube machines
- Pre-mixing tanks for tempered water
- High-pressure cleaning with water containing *Legionella* or flushing of surfaces with biofilm
- Cooling towers
- Certain humidifiers

It was concluded that there should not be specific limit values for *Legionella* in water systems (hot water supplies and cooling towers), only guideline levels. The guideline levels used in Denmark are those taken from EWGLI (2002).

The report recommended action plans and risk analyses of specific plants or systems as useful tools for the prevention of *Legionella* in new plants as well as existing ones. It concluded that once compliance with building regulations had been ensured, the effort involved in meeting the guidelines should be minimal.

References

[1] http://ec.europa.eu/health/ph_information/dissemination/echi/docs/legionellosis_en.pdf

[2] Overview of agencies dealing with biological risks in Denmark: http://ec.europa.eu/health-eu/my_environment/biological_risks/ms_dk_en.htm

[3] Statens Serum Institut website: http://www.ssi.dk/sw379.asp

[4] Arbejddstilsynet website: http://www.at.dk/sw12158.asp

[5] Jeppesen, C., Pringler, N., Tvenstrup Jensen, E., Uldum, S. (2004) Forekomst af *Legionella* – Risikovurdering, Statens Serum Institut Miljøprojekt Nr. 897.

4.3.7. Estonia

Introduction

There is no specific national policy for legionellosis prevention in Estonia, because the country has few cooling systems. Between two and seven cases of legionellosis are usually reported each year. Most of them are sporadic, community-acquired and not of occupational origin.

Legislation

Transposition of EU Directive 2000/54/EC was released in 2000 and the national regulation was updated in 2006 [1].

Policies

The Health Protection Inspectorate (Tervisekaitseinspektsioon) is the collaborator in EWGLI. Estonia follows the EWGLI and EU recommendations for *Legionella*.

The Labour Inspectorate (Tööinspektsioon) has published a document on biological safety at work environment [2] that only mentions *Legionella* as a risk factor.

References

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4.3.8. Finland

Introduction

In Finland legionellosis is rare since 15 *Legionella* pneumonia cases in avarage were reported from 1995 to 2009. The prevalence in Finland has been 3,0 cases/one million inhabitants compared to 7,7 in average in Europe during the time period mentioned. Attention focused on the presence of *Legionella* spp. in the work environment when cases were reported in Sweden. This has led to surveys especially in the forest industry sector. The FEEL (Finnish Forest Industry Employees' Exposure to Legionella) carried out studies that were completed in 2007 [1].

In 2007 there was an outbreak of Pontiac fever at an industrial water treatment plant with at least 5 diseased and thirteen asymptomatic workers had positive Legionella antibodies.

More recently, in 2007-8 a pneumonia cluster was discovered among thermal power plant workers. Part of the workers had indications of Legionella infection in antibody tests.

Legislation

The Occupational Safety and Health Act [2] regulates the Finnish work environment. This regulation refers to the Framework Directive, and it names biological agents. A governmental decree specifies occupational health and safety issues concerning biological agents [3]. The Decision of Ministry of Social Welfare and Health [4] and its related Communication [5] published the list of relevant biological agents including *Legionella*. This is a transposition of Directive 2000/54/EC.

According to the Finnish Building Codes [6] published by the Ministry of Environment, in new houses the hot water temperature must be between 55 and 65 °C, and cold water should be cooler than 20°C.

Standards

Water quality – Detection and enumeration of *Legionella*. International standard ISO 11731. 1998.

Policies

The National Institute for Health and Welfare (Terveyden ja hyvinvoinnin laitos) is the collaborator of EWGLI for Finland.

The studies carried out by FEEL in the forestry sectors resulted in the publication of recommendations for wearing respiratory protection when working at waste water treatment plants. After the completion of the studies the recommendations were updated in 2008, but have not yet been published [7]. There there is a labour inspectorate circular dated November 1988 giving guidance on Legionella in ventilation and water systems - including cooling towers and warm tap water systems.

References

[1] Kusnetsov, J., et al., Kansanterveyslaitos (2008) Metsäteollisuuden työntekijöiden altistuminen legionelloille ja muille hengitysteitse infektioita aiheuttaville ympäristöbakteereille (Finnish forest industry employees' exposure to *Legionella* and other respiratory pathogens, FEEL). Retrieved 30 June 2009 from: http://www.ktl.fi/portal/suomi/osastot/ytos/tutkimus/vesi/feel

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[5] Turvallisuustiedote 43 Biologisten tekijöiden luokitus. Retrieved 30 June 2009 from: http://www.tyosuojelu.fi/upload/pswh31pd.pdf

[6] D1 Suomen Rakentamismääräyskokoelma. Retrieved 30 June 2009 from: http://www.finlex.fi/data/normit/28208-D1_2007.pdf

[7] Suositus *Legionella*bakteeria koskevaksi työsuojeluohjeistukseksi. No reference available.

4.3.9. France

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for France is 206 (0.3) for 1997, 381 (0.6) for 1998, 440 (0.7) for 1999, 610 (1.0) for 2000, 807 (1.3) for 2001, 1,021 (1.7) for 2002, 1,044 (1.7) for 2003, 1,202 (1.9) for 2004, 1,527 (2.4) for 2005 and 1,443 (2.3) for 2006 [1]

According to a study by the French Institute for Public Health Surveillance (Institut de Veille Sanitaire, InVS) [2], between 1998 and 2007, 9,935 cases were notified but few outbreaks occurred. During this period just 14 outbreaks were identified, corresponding to 380 (3.8%) of the notified cases. The local authorities detected 12 outbreaks, while the EWGLI network and the National Reference Centre for

Legionella (Centre National de Référence des Légionelles) detected one case respectively. Fourteen cases from three outbreaks were reported by EWGLI. Outbreaks occurred throughout France. The median number of cases in outbreaks was 22 [range 11–86]. More than 40 cases were reported in one outbreak (Lens). In 13 of the 14 outbreaks, the National Reference Centre for Legionella compared by PFGE (Pulsed field gel electrophoresis) typing human and environmental strains. For eight outbreaks, a cooling tower was identified as the source of the contamination and for five more cooling towers were suspected. In one, a spa bath was suspected as the source of infection.
During the last 10 years, few cases have been related to outbreaks. Only one outbreak, in Lens, had more than 40 cases. The reinforced surveillance system for Legionnaires' disease has enabled more rapid detection and investigation of outbreaks. The availability of clinical isolates contributed to the identification of the outbreak sources. Cooling towers were the most probable source of the majority of outbreaks. These data emphasised the need to strengthen regulations in order to better control the dispersion of *Legionella* from these sources [2].

Legislation

The Ministry of Employment administers occupational health and safety. There are various consultative bodies in the field of health and safety including the National Agency for the Improvement of Working Conditions, the Higher Council for the Prevention of Preventional Risks and the National Institute for Research and Safety (INRS). The French regulations on biohazards are found under Work Code, Articles R. 231-51 to R 231-71 and cover biological agents in the workplace [3, 4, 5].

Following a series of outbreaks, new legislation [6] was introduced concerning the surveillance and control of cooling towers in hospitals (2003), the surveillance and control of all cooling towers (2004), the investigation and surveillance guidelines (2005) and the organisation of the response to outbreaks (2006)

As in most European countries, regulations in France dealing with *Legionella pneumophila* concern only the quality of water [7, 8, 9].

Policies

France is a member of the European Working Group for Legionella Infections Network (EWGLINET) and the national collaborators are the Centre National de Référence des Légionelles, Groupe Hospitalier Est, Institut de Microbiologie [10] and the French Institute for Public Health Surveillance (Institut de Veille Sanitaire, InVS) [11], a governmental institution reporting to the Ministry of Health, which is responsible for surveillance and alert in all domains of public health. Created by Law 98-535 dated 1 July 1998, to reinforce health surveillance and the safety of products intended for human use, its mandates were enlarged by the Public Health Policy Act of 2004, in order to meet the new challenges highlighted by recent health and emerging risks [11].

In France, the surveillance of Legionnaires' disease was established in 1987 with a mandatory notification based on clinical diagnosis. Cases are reported to local health officers who in turn notify national health authorities (Institut de Veille Sanitaire). The identification of a case, according to this system, involves a clinical diagnosis of pneumonia with a biological confirmation (culture confirmation, serological tests, direct fluorescent antibody staining, or *Legionella* urinary antigen test). Information about age, sex, residential postcode, risk factors and exposure during the 10 days before the onset of the disease is also collected. The notification process was changed in 1997 and the case was redefined by the inclusion of *Legionella* urinary antigen test, a new notification card and a better collaboration with the information sources such as the National Reference Centre for Legionella [12].

In France, all nosocomial cases of Legionnaire's disease and clusters or linked cases (travel-associated or in the community) are investigated. Isolated strains are sent to the National Reference Centre for Legionella, where identical strains from the same source can be identified.

References

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4.3.10. Germany

Introduction

Legionella was declared a notifiable disease after the implementation of the Protection against Infection Act (Infektionsschutzgesetz – IfSG; see below). 413 infections were reported in 2002, 395 in 2003 and 475 in 2004. These figures correspond to an incidence of about 5 cases per million inhabitants, but according to prevalence studies the estimated number of unreported cases is about 10,000 to 30,000 diseases per year [1]. A survey shows that 30% to 70% of public buildings are contaminated with *Legionella* [2]. Operators or owners of water systems have to take preventive measures according to national legislation and standards.

Legislation

Protection against Infection Act (Infektionsschutzgesetz IfGS):

This Act came into force in January 2001. Its purpose is to prevent communicable diseases in human beings, to detect infections at an early stage and to prevent their spread. According to this Act legionellosis is a national notifiable disease [3].

Standard values for the quality of drinking water are regulated in the German Drinking Water Ordinance (DWO) (Trinkwasserverordnung (TrinkwV 2001)) [4]. The Ordinance covers provisions on drinking water quality, the obligations of operators of water supply facilities and supervision by the health authorities with respect to hygiene. Microbiological requirements of water for human use are defined in section 5 of the Ordinance. It also provides limit values for pathogens and substances harmful to health and, and defines the scope and frequency of testing. Annex 4 of the Ordinance stipulates the frequency of testing for *Legionella* in central warm water systems.

Occupational health and safety

EU Directive 2000/54/EC was transposed into law in Germany through the Ordinance on Biological Agents (Biostoffverordnung) [5]. This ordinance is based on the Arbeitsschutzgesetz (Labour protection law) and applies to activities involving biological agents including activities in their risk area. This includes workers who are not working directly with biological agents but may be affected by biological agents at their workplace (e.g. because they are unintentionally handling biological agents or others near them are working with biological agents). The Ordinance is accompanied by the Technical Rules for Biological Agents (TRBA), which reflect the state of the art regarding safety, occupational health and hygiene.

Technical rules

The Technical Rules for Biological Agents list statutory requirements in terms of safety, occupational health, hygiene and work science with respect to activities involving the handling of biological agents [6]. The TRBA 250, published in Germany in October 2003, details specific recommendations to prevent medical sharp injuries, including the use of medical technology that incorporates needle protection.

Relevant technical rules for the prevention of *Legionella* infections are

- TRBA 466 'Einstufung von Bakterien und Archaebacterien in Risikoguppen' (Classification of bacteria and archaea in risk groups) [7]
- TRBA 500 'Allgemeine Hygienemaßnahmen: Mindestanforderungen' (General hygienic prevention measures: minimum requirements) [8]
- TRBA 400 'Handlungsanleitung zur Gefährdungsbeurteilung und für die Unterrichtung der Beschäftigten bei Tätigkeiten mit biologischen Arbeitsstoffen' (Guideline for risk assessment and for the instruction of employees in relation to activities with biological agents) [9]

Other regulations

The statutory accident insurance bodies (Berufsgenossenschaften) have issued different accident prevention regulations. The accident prevention regulations are legally binding upon the employers concerned and the insured individuals, while the rules describe how the regulations may be implemented in practice.

Standards

The drinking water ordinance TrinkwV 2001 is accompanied by generally accepted national codes of practice on the proper treatment and distribution of drinking water. Planners, installers and operators can obtain information and instructions in German Technical and Scientific Association for Gas and Water (DVGW) worksheets, DIN-standards and VDI-guidelines [10].

DIN is the German Institute for Standardisation. It is a non-profit organisation that develops norms and standards for industry, the state and society as a whole. It is the acknowledged national standards body that represents German interests in European and international standards organisations.

Regarding *Legionella*, DIN has published the following technical rules:

- DIN 1988 'Drinking water supply systems; materials, components, appliances, design and installation' [11],
- DIN 4753-1 'Water heaters and water heating installations for drinking water and service water; requirements, marking, equipment and testing' [12] and
- DIN 19643 'Treatment of water of swimming pools and baths – Part 5: Combination of process: Flocculation, filtration, adsorption by granular activated carbon; chlorination' [13]

VDI is the Association of German Engineers, an independent non-profit organisation. One of its functions is the transfer of technical knowledge to engineers and students. VDI guidelines are trend-setting working documents for everyday use and have a legal importance at the national level, for example by their inclusion in acts, ordinances, decrees or regulations [14].

The guideline VDI 6023 'Hygiene for drinking water supply systems – requirements for planning, designing, operation and maintenance' contains nearly all instructions that have to be considered in hygiene-conscious planning, execution, and operation and servicing of drinking water systems to prevent *Legionella* growth [15]. According to this regulation the following actions are important for the prevention of *Legionella* growth in water systems:

- Refraining from oversizing water systems

- Use of appropriate material for piping
- Ensuring water does not become stagnant
- Preventing water getting to a temperature that promotes bacterial growth
- Removal of pipes that are no longer used

Hygienic standards for ventilation and air-conditioning systems are defined in the guideline VDI 6022 [16]. It stipulates the requirements for the planning, design, operation and maintenance of ventilation and air-conditioning systems to ensure hygienic conditions according to the latest standards.

The codes of practice have been generally accepted and applied in the drinking water sector. If planners, installers and operators follow these technical regulations and advice, they can be sure that the drinking water reaching the customer complies with the statutes of the drinking water ordinance [17].

Policies

Germany has a complex public health structure with 16 states and about 450 local health departments reporting indirectly or directly to the Robert Koch-Institut (RKI) at national level [18].

The collaborators of EWGLI in Germany are the following institutions:

- Robert Koch Institut, Berlin
- Institut für Medizinische Mikrobiologie und Hygiene (Institute of Microbiology and Hygiene), University of Regensburg
- Institut für Medizinische Mikrobiologie und Hygiene (Institute of Microbiology and Hygiene) University of Dresden.

The RKI is the central federal reference institution for applied and response-orientated research as well as for the Public Health Sector [19]. With the passing of the Prevention against Infection Act (IfSG), the RKI was given the task of developing concepts for the prevention of communicable diseases as well as for the early detection of infections and the prevention of their spread. This includes the development and conduct of epidemiological and laboratory analyses, as well as research into the causes, diagnosis and prevention of communicable diseases.

The Federal Ministry for Labour and Social Affairs (Bundesministerium für Arbeit und Soziales, BMAS) is responsible for safety and health legislation in Germany and publishes the ordinance concerning biological agents [20].

The Commission for Biological Agents (Ausschuss Biologische Arbeitsstoffe, ABAS) advises the BMAS and supports the implementation (Advisory board) of the ordinance. The ABAS employs 17 experts representing social partners, trade unions, employers, and authorities of the federal states, statutory accident insurance bodies and universities. The committee normally meets twice a year. Its most important tasks are:

- to specify the requirements laid down in the ordinance;
- to clarify questions and problems regarding biological agents at work;
- to advise the Federal Ministry of Labour and Social Affairs on general questions of biological safety; and
- to develop the Technical Rules for Biological Agents at Work (TRBA) [21].

The Coordinating Circle for Biological Agents at Work (KOBAS) is a prevention committee set up by the statutory accident insurance sector. KOBAS deals with occupational safety and health issues relating to biological agents at work. It helps the accident insurance bodies to form an opinion on how to interpret the Ordinance for Biological Agents and the regulations which supplement it, and develops policy for the insurance bodies regarding preventive measures that should be taken when using biological agents at work [22].

To help companies implement the regulations, the accident insurance bodies provide information leaflets that include codes of practice and sector-specific checklists [23].

Information from the statutory accident insurance institutions that deals with *Legionella* infections and its prevention includes:

- BGI 858: Gesundheitsgefährdungen durch biologische Arbeitsstoffe bei der Gebäudesanierung (Health risk through biological agents while maintaining buildings) [24]
- BGI 805 – Tätigkeiten mit biologischen Arbeitsstoffen in der Metallindustrie (activities with biological agents in the metal industry) [25]
- BGI 633 – Sichere Biotechnologie- Einstufung biologischer Arbeitsstoffe: Procaryonten (Safe biotechnology – Classification of biological agents: procaryotes) [26]
- BGW Check: Gefährdungsbeurteilung in Beauty- und Wellnessbetrieben (Risk assessment in Beauty and wellness companies) [27].

Measures for reducing *Legionella* growth in pipeline heating systems and potable water heating systems are stipulated by the DVGW (German Technical and Scientific Association for Gas and Water) worksheets W 551, W 552 and W 553. The DVGW worksheet W 552 lays down limit values and benchmarks of *Legionella* concentration in water and describes measures that can be taken to limit contamination [28].

The VDMA (Verband Deutscher Maschinen- und Anlagenbau; German Engineering Federation) is one of the key association service providers in Europe and offers the largest engineering industry network in Europe.

VDMA provides a guideline on how to operate air-conditioning systems safely (VDMA Einheitsblatt 24649) [29].

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4.3.11. Greece

Introduction

In Greece, *Legionella pneumophila* was isolated and identified for the first time in 1989, in hotel water distribution systems, and was associated with cases of legionellosis. Moreover, the European Surveillance Scheme for Travel-Associated Legionnaires' reported 441 cases of *Legionella* infection for travellers in Greece from 1987 to 2008 [1]. In the same period, 11 cases were reported in Greece.

Legislation

The Ministry of Health and Social Solidarity issued a circular on 30 August 2005 entitled 'The Prevention of Legionella disease'. The circular described conditions favourable for the spread of the disease in Greece, its symptoms, the population groups with higher risk of exposure, laboratory diagnosis and measures to prevent its development. The annex of this circular includes important guidelines for the control and prevention of *Legionella* disease for travellers. These guidelines were processed by EWGLI. came into force on 1 July 2002.

A chapter on protecting employees' health and safety from biological agents is integrated into Law 1568/1985 (177/A/18.10.1985), 'Health and Safety of Employees'. The law has been supplemented by the Presidential Decree 17/96 (11/A/18.1.96), 'Measures for the improvement of workers' health and safety' transposing directives 89/391/EEC and 91/383/EEC. More specifically, the obligations of employers, manufacturers, importers and suppliers are specified, concerning the biological agents that workers may be exposed to, the protective measures that must be taken, the check-ups that they should undergo and the information that they must receive. Nevertheless, the law does not mention *Legionella* explicitly.

Under the authorisation of the above law, Presidential Decree 186/1995 (97/A/30.5.1995) 'Protection of workers from risks related to exposure to biological agents at work, transposing Council Directives 90/679/EEC and 93/88/EEC' was issued. In Annex III of this decree, biological agents are classified in four risk groups, according to the extent of infection hazard. *Legionella* has been set as a biological agent in Group 2. This group contains biological agents that can cause disease in humans and could be a hazard to workers, while there is a limited possibility that they will spread widely. For this type of

agent effective prevention and medical treatment are available. P.D. 186/1995 has been modified by P.D. 15/99 (9/A/2.2.99) and P.D. 174/97 (150/A/15.7.97) [2].

Standards

The Hellenic Organisation for Standardisation has issued standard ELOT EN ISO 11731.02/ 25.02.2009 'Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts' [3].

Policies

Greece has been a member of the EWGLI network since 1981 and is a signatory of the European guidelines. The HCIDC (Hellenic Centre for Infectious Diseases Control and Prevention), which belongs to the Ministry of Health and Social Solidarity, is the authorised body that collaborates with EWGLI.

The HCIDC's Department for Epidemiological Surveillance and Intervention is responsible for the surveillance of *Legionella* disease in Greece [4]. Cases are recorded by HCIDC, which obtains information from the health departments of the prefectures, hotels and hospitals, in order to find the source of infection, control the spread of the disease and promote effective preventive measures. Registration of *Legionella* diseases must be carried out within 24 hours of the diagnosis. The investigation of cases, as well as the promotion of control and prevention measures, is carried out by the local health departments of the prefectures. When a case is associated with a hospital, the hospital's own infections commission undertakes risk assessment and determines the measures to be taken, in cooperation with the hospital's technical service.

For every confirmed case of *Legionella* EWGLI informs the HCIDC about persons who have travelled in Greece and for their accommodation during the period of incubation of the disease. The HCIDC then informs the health departments of those prefectures where an infected person spent time. The health departments carry out an investigation. Both the information about the cases and the results of the investigation are entered in a database. The results are sent to EWGLI.

The National School of Public Health (NSPH), Department of Public Health Microbiology, carries out the analysis of *Legionella* and other infectious microorganisms that may affect public health.

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4.3.12. Hungary

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for Hungary is 18 (0.2) for 1998, 27 (0.3) for 1999, 42 (0.4) for 2000, 55 (0.5) for 2001, 65 (0.6) for 2002, 126 (1.2) for 2003, 37 (0.4) for 2004, 13 (0.1) for 2005 and 12 (0.1) for 2006 [1].

Legislation

The Hungarian transposition of Directive 2000/54/EC of the European Parliament and of the Council is in force [2].

The amendment of a decree concerning public baths will be published soon in order to include mandatory quarterly *Legionella* sampling at spa baths [3].

Standards

The standard on the 'Ventilation for Buildings. Ductwork. Requirements for ductwork components to facilitate maintenance of ductwork systems' MSZ EN 12097:2006 is based on VDI 6022. It specifies biannual inspection of central ventilation systems with humidity controls and inspection at least every three years of ventilation systems without humidifiers. [4]

Policies

The National Centre for Epidemiology (OEK Országos Epidemiológiai Központ) is the Hungarian collaborator in EWGLI.

In Hungary legionellosis must be reported to the regional institute of the National Public Health and Medical Officers Service (Állami Népegészségügyi és Tisztiorvosi Szolgálat – ÁNTSZ) [5].

Cases of suspected occupational origin should also be reported to the regional office of the Hungarian Labour Inspectorate (Országos Munkavédelmi és Munkaügyi Főfelügyelőség – OMMF). Hungarian occupational diseases are underreported. The number of occupational *Legionella* diseases ranges from one to four cases per year, reported from administrative, healthcare and food processing sectors.

The National Centre for Epidemiology together with the National Institute of Environmental Health (Országos Környezetegészségügyi Intézet – OKI) have published a guideline on Legionnaires' disease and its prevention [6]. It includes a checklist on the maintenance of cooling towers. A list of parameters to be monitored (ion-levels, microbiologic activity, biocide level, etc.) is included. The guidance recommends regular checks of water based on assessed risk. It is recommended that samples be taken for *Legionella* testing in cooling water systems four times a year. Air-conditioners should also be serviced at least four times a year. The guideline includes a list of recommended activities during maintenance of outdoor and indoor split air-conditioners:

- careful examination of the machine, identification of any stagnant water
- samples taken from identified suspected places
- professional removal of stagnant water without aerosol forming
- disinfection of suspected places with biocide substances or hot air gun
- professional elimination of causes of stagnation
- control of free condensed water outflow
- trial operation if significant modification of the system was done.

These recommendations were developed with the cooperation of the National Association of Hungarian Air-conditioning Service Enterprises (Magyar Klímaipari Szolgáltató Vállalkozások Országos Szövetsége), which has also published a brief guide on the topic at their website [7]. Annex 6 and 9 of the guideline are designed for the needs of hotels, buildings, service, maintenance and operation sectors to reduce *Legionella* risks. In Annex 11 of the recommendation there is also a detailed checklist on the maintenance of hot and cold ducting systems and shower heads, and a checklist for other systems that can induce health problems due to the growth of *Legionella*: air-scrubbers, water softeners, emergency showers, tube fire-extinguishers, liquid cooler system of machine tools in metal working, spas, sprinkler systems, cooler systems of dental machines, car/bus washes, (mainly indoor) fountains.

The guideline recommends on-site inspection and sampling surveillance of cumulative diseases.

The guideline is focused mainly on public health issues and product quality and it pays little attention to the protection of workers.

The entire EWLGI guideline has been translated and adapted to the Hungarian situation [8].

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4.3.13. Ireland

Introduction

There were 67 cases of Legionnaires' disease reported in Ireland between 2000 and 2007. There were five deaths due to Legionnaires' disease during this period, giving a case fatality rate (cfr) of 7.5%. Forty-five cases (67.2%) were male, and 22 (32.8%) were female. Forty-one cases (61.2%) were travel-associated, 21 (31.3%) were community-acquired, and five (7.5%) were nosocomial. Fifty-seven cases (85.1%) were classified as confirmed and 10 (14.9%) as probable.

Legislation

In Ireland, the principal legislative provisions relevant to the prevention of Legionnaires' disease in the workplace include:

- The Safety, Health and Welfare at Work Act 2005;
- The Safety, Health and Welfare at Work (General Application) Regulations 2007;
- The Safety, Health and Welfare at Work (Biological Agents) Regulations, 1994 as amended in 1998; and
- The Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001.

While they are not directly related to *Legionella*, employers are obliged to consider the requirements of these regulations to ensure that their workers are not at risk from exposure to chemicals while at work and/or performing a work activity in which chemical agents are being used. In this regard therefore, chemical agents in the form of biocides and disinfectants, etc. are used as a means of controlling aspects relating to the presence of *Legionella* and for cleaning purposes.

In any workplace there is an obligation on employers, persons who have control to any extent of a place of work and to those installing plant or equipment to control exposure to *Legionella* as follows:

1. A documented risk assessment must be undertaken by a competent person to determine whether conditions exist that allow the proliferation and aerosolisation of *Legionella* bacteria together with the potential for human exposure to such aerosols. The risk assessment must be reviewed, particularly where any changes are made that could have an impact on the risk e.g. alterations to plumbing system, changes to work practices.
2. Where a risk has been identified, appropriate action must be taken to minimise or preferably eliminate the risk of exposure to *Legionella*. Details of the risk and control measures implemented must be included in the workplace safety statement.
3. Adequate information must be communicated to employees about the risk and appropriate training provided.
4. Control measures must be monitored and reviewed.

Risk assessments and records have to be site-specific, maintained and made available to the HSA or a medical officer of health (MOH) when requested or required.

Legionnaires' disease is a statutorily notifiable disease in Ireland as defined by the Infectious Disease Regulations 1981. Under the Infectious Diseases Regulations (amendment) 2003, laboratory and clinical notification of Legionnaires' disease is mandatory.

Policies

Ireland is member of the European Working Group for Legionella Infections (EWGLI) and the collaborator is the Health Protection Surveillance Centre (HPSC), [1] formerly the National Disease Surveillance Centre (NDSC).

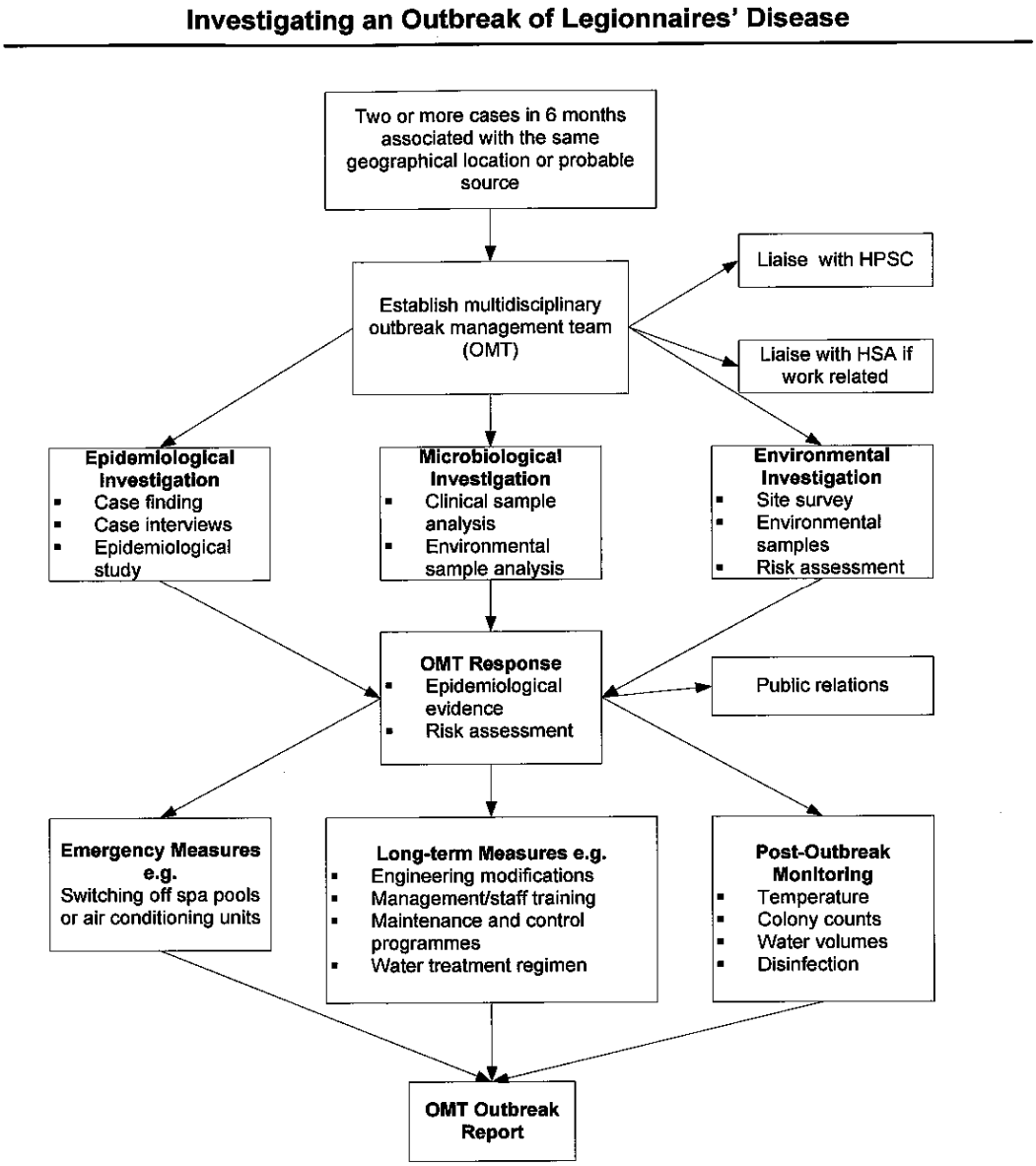
The Health and Safety Authority of Ireland (HSA) [2] administer the laws on occupational health & safety7.

Under the Infectious Diseases (Amendment) (No.3) Regulations 2003, laboratory and clinical notification of legionnaires'disease is mandatory. Cases should be notified to the MOH in the relevant department of public health. Cases of Legionnaires' disease were notified to the Department of Health and Children (DoHC) until 2000, when the Health Protection Surveillance Centre (HPSC) took over responsibility for the collation of infectious diseases notifications.

Under the Infectious Diseases Regulations it is also mandatory for a medical practitioner and a clinical director of a diagnostic laboratory to alert the MOH to any unusual clusters or changing patterns of any illness that may be of public health concern. The MOH in turn must notify the HPSC.

If a community cluster or outbreak is recognised as having a potential workplace association, HSA will be involved with other agencies in an incident investigation. The flow diagram in Figure 2 summarises the actions that will be taken and those involved.

Figure 2: The steps in investigating an outbreak of Legionnaires' disease



Source: HPSC

Data on clinically recognised cases of Legionnaires' disease are collated by the HPSC and published on its website.

References

[1] The HPSC website: http://www.hpsc.ie/hpsc/A-Z/Respiratory/Legionellosis/Factsheet/

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4.3.14. Italy

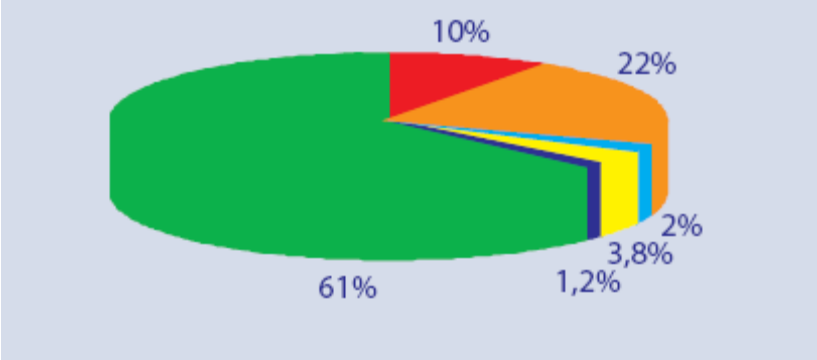
Introduction

The Italian National Institute of Health (Istituto Superiore di Sanità, ISS) has launched a national independent *ad hoc* surveillance system for legionellosis (Italian National Legionellosis Register). In its last Annual Report 'Legionellosis in Italy' [1], data regarding cases of legionellosis diagnosed in Italy in the year 2007 and notified to the National Surveillance System are analysed. Overall, 862 reports of *Legionella* were sent to the Italian National Institute of Health: 816 confirmed, and 46 probable. Just six regions accounted for 75% of cases: Lombardy, Piedmont and Lazio, Tuscany, Veneto, Emilia-Romagna. The remaining 25% were from 14 regions and two independent provinces (Bolzano and Trento). One region failed to send a report [1]

The annual report concerning legionellosis cases diagnosed in 2007 showed that the characteristics of the patients are very similar to those of previous years in terms of gender ratio, age-specific distribution, occupation, etc. The analysis of age distribution shows that 73% of the cases are older than 50 years and that the patients' mean age is 61 years, with an inclusive range between 6 and 99 years. Seventy-one percent of legionellosis cases are found in males and the male:female ratio is 2.5:1.

Sixty-six percent of the patients affected with legionellosis showed other concomitant pathologies, primarily chronic-degenerative (diabetes, hypertension, chronic-obstructive broncopatia) and neoplastic. *Legionella pneumophila* serogroup 1 was responsible for the disease in 94% of the cases. The distribution of the number of cases with respect to the place of possible exposure to the infection is shown in Figure 1.

Figure 3: Distribution of cases with respect to the place of possible exposure to the infection



The occupation of the infected persons is also recorded in order to assess whether some occupations or activities are associated with a high infection risk. Among the cases for which this information is available, 55% were pensioners, 14% workers, 7% employees, 5% housewives, 3% free professionals and 16% of other categories of workers.

Table 4: **Distribution of cases by occupation**

Occupation	%
Pensioners	55
Workers	14
Employees	7

Occupation	%
Housewives	5
Professionals	3
Other categories of workers	16

Source: [1]

Nosocomial legionellosis

In 2007, the nosocomial cases were 86 (10% of the total notified cases), of which 42 (49%) of certain source and 44 (51%) of probable source. Four regions (Piedmont 11 cases, Lombardy 23 cases, Campania 10 cases and Trento 9 cases) have notified over 60% of all nosocomial cases. The number of cases of certain or probable nosocomial source notified by each region is shown in Table 5. Fifteen clusters were noted: five in hospitals in Lombardy, three in hospitals in Piedmont, two in Campania and one cluster each in Veneto, Liguria, Tuscany, Lazio and Trento. Four hospitals notified the largest clusters (8, 7, 6 and 5 cases respectively), while the other clusters had 2 to 4 cases each, from a total of 53 cases. Thirty-three hospitals have notified just one nosocomial case confirmed or probable.

Table 5: Nosocomial cases of legionellosis notified for each Italian region in 2007

Region	Nosocomial cases
Piedmont	11
Lombardy	23
Bolzano	2
Trento	9
Veneto	3
Friuli Venezia Giulia	6
Liguria	1
Emilia Romagna	5
Tuscany	5
Umbria	6
Marche	2
Lazio	4
Campania	10
Apulia	1
Sicily	1
Total	**89**

Source: [1]

The mean age of the nosocomial cases was 67 years, ranging between 18 and 97 years. The patients had primarily been hospitalised for chronic-degenerative pathologies (51%), neoplasias (30%), infectious diseases (8%) and other pathologies (11%). The effect of the illness was known for 46.5% of the cases and the mortality rate among the nosocomial cases was 37.5%, while among community-acquired cases it was 6%. Sixteen cases were notified and linked to the duration of stay in retirement homes or medical facilities.

Travel-associated legionellosis

329 cases of travel-associated legionellosis cases were notified in 2007, including both Italian tourists and foreigners. There were 186 cases among Italian tourists, of which 70% were associated with hotels, 5% camping facilities, 21% private residences and 4% thermal spas. The majority of the Italian tourists had travelled within Italy and only 9% of the cases originated from a foreign travel destination.

Legionellosis cases notified to the ISS by the EWGLINET totalled 143 in 2007. Of these cases, 75 were Italians and 68 foreigners. The duration of the stay in the accommodation concerned was an average of six days. The clusters were small, involving two to three tourists each . Two hotels were implicated, with nine and seven cases respectively. Among the tourists four deaths were recorded [1].

A total of 862 legionellosis cases were notified to the ISS; a 7% fall compared to 2006. The incidence of legionellosis cases in 2007 was 15 cases per million of the population. There was little difference in the distribution of community-acquired, nosocomial and travel-associated cases in comparison with previous years, with the exception of the mortality level in nosocomial cases, which was higher than in 2006 (37.5% vs. 8.7%). Nevertheless, these data must be interpreted with caution because the outcome of an illness is not often reported as a Legionellosis case. In order to reduce the number of nosocomial cases and the number of associated deaths, it would be necessary to take preventive measures in the healthcare sector.

Legislation

In Italy, the occupational health and safety rules are set out in Decree No. 81, approved in April 2008 [2]. Decree No. 81/2008 replaced the old legislation on the protection of workers against risk agents (Decree No. 626 of 19 September 1994, subsequently modified and integrated by the Decree No. 242 of 19 March 1996) [3, 4]. Decree No. 81/2008 has introduced severe sanctions for enterprises that break safety rules. Companies that regularly violate safety rules risk being closed down. Contracts, subcontracts and supply contracts that do not specify costs concerning safety at work are invalid [5]. In Italy there is no regulation for the registration of wet cooling system/cooling towers.

Legionellosis has been a mandatory notifiable disease in Italy since 1983.

Standards

ISO n.11731: 1998 'Water quality-detection and enumeration of Legionella and the ISO n.11731-2: 2004 describe a monitoring method for the isolation and enumeration of Legionella bacteria in water intended for human use (e.g. hot and cold tapwater, water used for washing), for human consumption and for treated bathing water (e.g. swimming pools). The procedures described in the ISO n.11731-2: 2004 are also adopted for environmental investigations. Since the growth of *Legionella* spp. may be inhibited by the overgrowth of other bacterial colonies on the membrane, this method is only suitable for water with a low bacterial count.

Policies

The Italian National Institute of Health (Istituto Superiore di Sanità, ISS) has launched a national surveillance system, the Italian national Legionellosis register, which is independent from the system that records occupational diseases. A ministerial circular published by the Ministry of Health on 29 December 1993 [6] states that legionellosis should be reported to the Italian National Institute of Health (Istituto Superiore di Sanità, ISS). The hospitals have to send a report on legionellosis cases to the ISS containing full details about the patient, the clinical aspects and the possible sources of exposure.

The main objectives of the Italian national Legionellosis register are:

1. to monitor the frequency of legionellosis diagnosed in Italy, with particular attention to the risk factors for the infection;
2. to determine the trends of the disease;
3. to identify the environmental sources that may cause epidemic clusters in order to intercept the transmission risk;
4. to put into effect adequate measures of control.

At the end of each year, the information from the Legionellosis register and the Occupational Diseases System are compared. The local authorities follow up case reports not obtained from the *ad hoc* surveillance system. Despite this dual information system, the number of legionellosis cases in Italy is underestimated, as some cases are either undiagnosed, or not reported by physicians.

Italy is a member of the European Working Group for Legionella Infections (EWGLI) and the national collaborator is the Italian National Institute of Health (Istituto Superiore di Sanità, ISS) [7, 8]. Italy receives the largest number of foreign tourists per year in Europe, after France and Spain. EWGLI collects information about foreign tourists who were infected in Italy. In July 2002, most EWGLINET participant countries, including Italy, voluntarily adopted European guidelines for the control and prevention of travel-associated Legionnaires' disease even though at that time the European Commission had not yet officially approved them. The system picks up information on cases of travel-associated legionellosis in the citizens of the 36 countries that belong to the programme. The Italian national surveillance system communicates to EWGLI the data related to the cases of legionellosis among Italian citizens, whether contracted during trips within Italy or to foreign countries, and foreign citizens who have visited Italy. The main benefit of the European guidelines is the rapid exchange of information among European countries through the EWGLINET network that allows the detection of clusters, even when cases are from a different country of origin.

In 2000 the Italian National Institute of Health issued 'Guidelines for the prevention and the control of the legionellosis' [9], which sets out possible strategies of intervention for hospitals, schools, care homes, hotels, offices, swimming pools, etc. These guidelines describe the procedures for sampling and analysis of water, deposits, filters and diagnostic techniques.

In 2005 'Guidelines regarding indications on legionellosis for the managers of tourist-receptive structures and thermal environments' were published [10]. For the first time, these guidelines describe some aspects of risk assessment and management showing some practical steps for the prevention and control of bacterial colonisation and multiplication in water-distribution systems. It also describes precautions for protecting the health of workers involved in the maintenance of water-distribution and air-conditioning systems. In the same year (2005), 'Guidelines regarding indications to the laboratories with activities on microbiological diagnosis and environmental control of the legionellosis' were also issued [11].

The Emilia Romagna region has issued its own guidelines: 'Regional guidelines for the monitoring and control of legionellosis' [12]. In 2008, the Hygiene and Public Health Direction of the Piedmont region also approved its own local guidelines [13].

References

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[2] Legislative Decree on safety at work – Ministry of Labour and Social Security: Legislative decree No. 81 of 9 April 2008. (Official journal No. 101, 30 April 2008)

[3] Decree No. 626 of 19 September 1994, Attuazione delle direttive 89/391/CEE, 89/654/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE, 90/394/CEE, 90/679/CEE riguardanti il miglioramento della sicurezza e della salute dei lavoratori durante il lavoro (Official Journal of the European Communities EN 8.4.1999)

[4] Decree No. 242 of 19 March 1996.

[5] http://ec.europa.eu/youreurope/business/doing-business-responsibly/meeting-social-rules/italy/index_it.htm

[6] ***Circolare*** del Ministero della Sanità n. 400.2/9/5708 del 29 dicembre ***1993. Also in:*** http://www.it.sgs.com/it/sgs-env-gestione-rischio-legionella-it-09.pdf

[7] http://www.ewgli.org

[8] www.eurosurveillance.org/ViewArticle.aspx?ArticleId=445

[9] Guidelines for the prevention and the control of the legionellosis. Gazzetta Ufficiale n. 103 of 05/05/2000.

[10] Guidelines regarding indications on the legionellosis for the managers of structures tourist-receptive and thermal environments. Gazzetta Ufficiale n. 28 of 04/02/2005.

[11] Guidelines regarding indications to the laboratories with activities on microbiological diagnosis and environmental control of the legionellosis. Gazzetta Ufficiale n. 29 of 05/02/2005.

[12] Official Bulletin of the Italian Region Emilia-Romagna – No. 147 of 22-8-2008: http://www.circuitoaw.it/aironeambiente/lineeguida_emilia_romagna.pdf

[13] 'Recommendations for the surveillance, prevention and control of ***pneumonias caused*** by Legionella bacteria in public and private healthcare facilities': http://www.legionellaonline.it/raccomandazioni_piemonte.pdf

4.3.15. Latvia

Introduction

Latvia reported no *Legionella* cases in 2000 [1], 2 cases in 2001, 3 in 2003, less than one case of *Legionella* disease per million population in 2003, 2004 [2] and 2005, 1 in 2006 [3], 2 in 2007 and 5 in 2008.

Legislation

Epidemiology

In Latvia the Law on Epidemiological Safety regulates surveillance for infectious diseases and procedures for ensuring epidemiological safety. It specifies the rights and duties of state authorities, local governments, and natural and legal persons in these areas [4]. The law is also applicable to legionellosis cases [5].

There are different regulations concerning early warning systems, including an order of the Ministry of Welfare that describes obligatory procedures for immediate (within 24 hours) notification of serious public health events, including an outbreak of three or more cases of legionellosis [6].

Occupational Health and Safety

The requirements of the Directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work have been transposed into the national legislation of Latvia through the Cabinet Regulation No. 189 [7] (Labour protection requirements at work with biological agents) that has been in force since 2003.

Paragraph 18 of the Regulations of the Cabinet of Ministers No. 256 of 21/07/1998 'Indoor water pipes and sewerage' [8] states that hot water temperature in outlet water should not be lower than 55 ˚C. Although *Legionella* is not specifically mentioned, the regulation serves as basis for *Legionella* control.

Standards

LVS EN ISO 11731-2:2008: Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts (Ūdens kvalitāte. Legionella noteikšana un uzskaite. 2. daļa: Ūdens ar zemu baktēriju skaitu tiešās membrānfiltrēšanas metode)

LVS ISO 11731:1998: Water quality – Determination and enumeration of Legionella (Ūdens kvalitāte – Legionella noteikšana un uzskaite)

Policies

Latvia is a member of the European Working Group for Legionella Infections (EWGLI) and the European Surveillance Scheme for Travel-associated Legionnaires' disease (EWGLINET). The National Environmental Health Centre of the Environmental Health Ministry is the EWGLI/EWGLINET collaborator.

EWGLINET's European Guidelines for Control and Prevention of Travel Associated Legionnaires' Disease [9] have superseded Latvia's national guidance for the control and prevention of Legionnaires' disease: 'Epidemiological surveillance of legionellosis'.

References

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[4] ECDC, *Country information*: Latvia, http://ecdc.europa.eu/en/countryinfo/Pages/Latvia.aspx

[5] Epidemioloģiskās drošības likums, http://www.likumi.lv/doc.php?id=52951

[6] WHO, *Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe 8th Report 1999-2000 Country Reports: Latvia*, p. 8: http://www.bfr.bund.de/internet/8threport/CRs/lva.pdf

[7] Ministru kabineta noteikumi nr. 189 'Darba aizsardzības prasības, saskaroties ar bioloģiskajām vielām' Legal act: Ministru Kabineta noteikumi; Official Journal: Latvijas Vēstnesis, number: 78, Publication date: 24/0 5/2002; Reference: (MNE(2003)59497) http://www.lm.gov.lv/upload/darba_tirgus/darba_aizsardziba/mk_189.pdf

[8] MK noteikumi Nr.256 'Noteikumi par Latvijas būvnormatīvu LBN 221-98 'Ēku iekšējais ūdensvads un kanalizācija, http://www.likumi.lv/doc.php?id=49286&from=off

[9] EWGLI, European Guidelines for Control and Prevention of Travel Associated Legionnaires' Disease, 2005, p. 58: http://www.ewgli.org/data/european_guidelines/european_guidelines_jan05.pdf

4.3.16. Lithuania

Introduction

Lithuania has reported very few cases of Legionnaires' disease in the past few years. According to the European Commission Health and Consumers Directorate, Lithuania had no legionellosis cases from 1998 to 2004. In 2005 Lithuania reported one case and in 2006 five cases of *Legionella* diseases [1].

Legislation

Infection

Epidemiological surveillance for legionellosis in Lithuania is controlled by the following orders (laws):

- 24 December 2002 Health Minister of Republic of Lithuania order No. 673 on mandatory epidemiological reporting (Žin., 2003, Nr. 12-444; 2004, Nr. 82-2961; 2008, Nr. 89-3585)

- 28 May 2004 Health Minister of Republic of Lithuania order No. 397 on procedures to be followed when communicable diseases are confirmed (Žin., 2004, Nr. 90-3317; 2008, Nr. 89-3587).

These two orders regulate information on registered communicable diseases. Order No 397 confirms the statutory notifiable list of communicable diseases that require epidemiological surveillance and stipulates the duty to inform about outbreaks.Legionnaires' disease is on the list of statutory notifiable communicable diseases.

The purpose of order No. 397 is to outline the basic steps in the prevention and control of communicable diseases in humans; dispute settlement and damage compensation and liability related to the issue; the rights and obligations of those involved in the control and prevention of communicable diseases; and specific characteristics of the funding of prevention and control of communicable diseases and compensation for the costs they give rise to [2].

Article 26 of the law concerning the competence of Municipal Institutions, responsible for the administation, prophylaxis and control of communicable diseases, stipulates among other things that:

1) The Municipal council during its legislative period must confirm an organisational plan to prevent and control communicable diseases. The implementation of the plan is controlled in cooperation with the municipal physicians.

2) The Municipal council must organise the protection of the sources of centralised supply of drinking water from microbe infestation and the supplying of drinking water in keeping with the standards of hygiene.

3) The Municipal council must coordinate the implementation of organisational, economic and technical measures, which limit harmful effects to human health by microbes through air, water, soil and animals.

Occupational Health and Safety

The requirements of Directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work have been transposed into the national legislation of Lithuania through the Regulation on Protection of Workers from Exposure to Biological Agents at Work (Dėl Darbuotojų Apsaugos Nuo Biologinių Medžiagų Poveikio Darbe Nuostatų Patvirtinimo) [3].

Standards

- LST EN ISO 11731-2:2008 'Water quality. Detection and enumeration of Legionella, Direct membrane filtration method for waters with low bacterial counts' (Vandens kokybė. Legionelių aptikimas ir skaičiavimas. 2 dalis. Tiesioginio membraninio fitravimo metodas, taikomas vandeniui, kuriame yra mažas bakterijų skaičius (ISO 11731-2:2004).

Policies

Lithuania is member of the European Working Group for Legionella Infections (EWGLI). The Centre for Communicable Disease Prevention and Control (CCDPC) (Užkrečiamųjų ligų profilaktikos ir kontrolės centras (ULPKC)) is the collaborating member.

The CCDPC was established in 1997 after the reorganisation of the State Immunisation Centre and the Department of Communicable Diseases at the State Public Health Centre. It organises, coordinates and gives methodological help for epidemiological surveillance of communicable diseases (including collecting and analysing relevant data) in Lithuania [4]. The CCDPC is the chief administrator for communicable diseases and registers infected people. The CCDPD assists with drafting communicable disease legislation and is also responsible for the organisation and coordination of vaccinations in Lithuania. In 2004 it prepared recommendations for legionellosis diagnostics, treatment, epidemiological surveillance and control, thus implementing European requirements for travellers. The same centre prepared in 2007 recommendations for legionellosis prevention and control in places with a high infection risk [4].

References

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3. Dėl Darbuotojų Apsaugos Nuo Biologinių Medžiagų Poveikio Darbe Nuostatų Patvirtinimo, http://www3.lrs.lt/pls/inter2/dokpaieska.showdoc_l?p_id=140647
4. ULPKC website: http://www.ulpkc.lt/index.php

4.3.17. Luxembourg

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for Luxembourg is 1 (0.2) for 2000, 0 for 2001, 3 (0.7) for 2002, 2 (0.4) for 2003, 7 (1.5) for 2004, 13 (2.8) for 2005 and 10 (2.1) for 2006 [1].

Legislation

The current law dealing with occupational health and safety [2] does not make reference to the Framework Directive. The latest modification of the relevant law on the protection of workers from risks caused by exposure to biological agents at work [3] instead refers to the former Directive 90/679/CEE. The regulation contains a list of biological agents, including *Legionella*.

Policies

The Health Inspection Division at the Health Directorate (Direction de la Sante – Division de l' Inspection Sanitaire) is the collaborator in EWGLI.

There are no known guidelines published in Luxembourg. Instead guidelines from France are used.

References

1. http://ec.europa.eu/health/ph_information/dissemination/echi/docs/legionellosis_en.pdf
2. Code du Travail, Livre III – Protection, Securite et Sante des Travailleurs. Retrieved 26 June 2009 from: http://www.legilux.public.lu/leg/textescoordonnes/codes/code_travail/Code_du_Travail.pdf#page=106
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4.3.18. Malta

Introduction

During the past few years a number of travel-associated cases of Legionnaires' disease have been reported to the Maltese health authorities. The Department of Public Health and its stakeholders agreed to draft new regulations for the control of *Legionella*. The Infectious Disease Prevention and Control Unit (IDCU) of the Department for Health Promotion and Disease Prevention published reports on the situation regarding Legionnaire's disease in Malta [1].

Table 6: Resident cases of Legionnaire's disease in Malta from 2000 to 2009

(Q1: Jan-March; Q2: April-June; Q3: July-Sept; Q4: Oct -Dec)

Year	Total	M	F	Q1	Q2	Q3	Q4
2009	1	1	-	1	-	-	
2008	2	1	1	-	-	2	-
2007	12	7	5	-	3	7	2
2006	2	1	1	1	1	-	-
2005	-	-	-	-	-	-	-
2004	1	1	-	1	-	-	-
2003	2	2	-	-	-	-	2
2002	-	-	-	-	-	-	-
2001	4	3	1	-	-	3	1
2000	10	5	5	8	-	1	1

Source: [1]

Legislation

The Department for Health Promotion has published two regulations concerning Legionella control under the Public Health Act 2003, namely L.N. 5 of 2006 and L.N. 6 of 2006.

L.N. 5 of 2006 deals mainly with the installation and design of cooling towers and evaporative condensers. It stipulates commissioning and operational procedures for cooling towers and evaporative condensers and the maintenance and testing requirements for cooling towers, evaporative condensers, hot and cold water systems, indoor water fountains and spas situated at all non-domestic premises. The person responsible for these premises is required to ensure that all the systems covered by these regulations are maintained and tested according to the European Working Group for Legionella Infections (EWGLI) Guidelines, and that water systems are maintained in a clean condition and disinfected regularly. These regulations also specify actions that must be taken following microbiological monitoring, and the obligation to notify the competent authorities.

L.N. 6 of 2006 mainly deals with the requirements for the registration of all cooling towers and evaporative condensers by the responsible person.

Policies

Malta has been member of the European Working Group for Legionella Infections (EWGLI) since 2004 and the national collaborator is the Disease Surveillance Unit (DSU), which is part of the Department for Health Promotion and Disease Prevention. The DSU is the national surveillance centre for communicable diseases in Malta.

References

1. http://www.health.gov.mt/DSU/

4.3.19. The Netherlands

Introduction

A report issued in 1986 by the Health Council of the Netherlands called for effective measures in all hospitals to prevent contamination of hot tapwater with *Legionella* bacteria. In other large establishments, preventive measures were not that urgent but if the temperature of hot water reached 60 °C at the tap similar measures had to be considered. The water in whirlpools (spa baths) had to contain at least 0.5 mg chlorine. Adequate prevention measures had to be taken in air-conditioning installations and cooling towers. Further measures were to be considered only if epidemical evidence occurred. The importance of temperature management for hot tapwater and regular cleaning and disinfection of air-conditioning installations was recognised. The Dutch Association of Water Supply Companies (VEWIN) initiated the update of the standard for drinking water systems installations (NEN 1006). Dutch hospitals report about 45 cases of Legionellosis every year. Awareness of the danger from *Legionella* infections used to be low, but that attitude changed dramatically in 1999.

A large outbreak in the Netherlands in 1999 was caused by a single non-disinfected whirlpool (spa bath) at a flower show at the city of Bovenkarspel. About 200 people were hospitalised and 28 died. *Legionella* became a hot political issue. The parliament asked for appropriate, adequate and timely action. Attention focused not only on whirlpools but on all water systems of domestic or industrial origin.

Legislation

In the wake of the 1999 outbreak the Ministry of Housing, Spatial Planning and the Environment (VROM) issued in 2000 a 'Temporary emergency act on *Legionella* prevention in drinking water' for a period of two years. The aim was to ensure the safety of so-called collective drinking water installations in hospitals, hotels, swimming pools, office buildings, industrial buildings, shops and flats. No preventive rules were set for private households.

In March 2005 VROM published a summary on legislation concerning the control of *Legionella* in water. Legionnaires' disease prevention was divided into proactive and reactive source cleaning. For preventive proactive cleaning, four laws were put in place for different water sources. The laws stipulated that in order to monitor the effectiveness of the preventive measures, must be taken from all drinking water sources at regular intervals.

The following laws, decrees or acts are directly or indirectly related to Legionnaires' disease:

1. **Water Supply Law** (Applicable on 24.06.2009) (Waterleidingwet, Geldend op 24-06-2009)

This law law includes the general duty of every owner of a public water system to assure the adequacy of the available water (Article 4, first paragraph).

2. **Water Supply Decree** (Applicable on 24 June 2009) (Waterleidingbesluit)

This act (in particular the new Chapter IIIC) changes the temporary arrangement (Temporary Emergency Act on Legionella Prevention in Drinking water) that was in force from 28 December 2004. Chapter IIIC defines rules relating to the prevention of *Legionella* in drinking water. Risk assessment and management plans for public water and public networks must be put in place.

3. **Decree on hygiene and safety in bath facilities and swimming pools** (Applicable on 24 June 2009) (Besluit hygiëne en veiligheid badinrichtingen en zwemgelegenheden)

This act establishes rules how *Legionella* contamination in swimming pools, saunas and other facilities should be avoided. A risk assessment and risk analysis should be carried out.

4. **The Dutch Safety and Health Act (Arbowet)**

The Ministry of Social Affairs and Employment (SZW) is responsible for the implementation of the EU directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work. With the Arbowet the government has established the legal framework within which employers and employees are expected to fulfil their responsibilities. Among other things, the law requires that employers do everything in their power to prevent or limit illness among their employees. The Health & Safety Act also requires employers to have the risks to their employees surveyed and evaluated in writing. The Labour Inspectorate ensures compliance with the legislation. A number of financial measures have been implemented to reward good conduct and to penalise bad practices. The Ministry also encourages both management and workers to cooperate and take an active role, and encourages all parties involved to actively increase their expertise.

5. **Working Conditions Decree (Arbobesluit)**

The employer must apply the provisions of the Working Conditions Decree to any work involving hazardous substances and biological agents.

Standards

- NEN 1006 General requirements for tapwater installations (AVWI-2002)
- The standard gives the rules for the control of technical quality and the control of all collective installations of water supply; this covers the prevention of *Legionella*.
- NEN 6265: 2007 'Detectie- en telling van *Legionella*' (Detection and enumeration of *Legionella*)

This standard provides a method for the detection and quantification of *Legionella* bacteria in water. Characteristic colonies are further examined by means of pure culture and performing confirmation and typing reactions. The standard is applicable for the bacteriological examination of drinking water, bathing water, cooling water, rainwater, surface water and waste water, etc.

The Netherlands obtained a deviation from ISO 11731-2 standard because the Dutch regulation for detection of *Legionella* requires the use of standard NEN 6265: 2007 as the reference method.

Policies

The Netherlands is a member of EWGLI and the national collaborator is the National Institute for Public Health and the Environment (RIVM).

According to the 'Temporary emergency act on *Legionella* prevention in drinking water', positive tests from the mandatory water samples had to be reported to the VROM inspectorate. The local public health service was notified in case of a positive culture with more than 1,000 colony-forming units per litre, so that it could give information to the users of the contaminated water installation and, if possible and applicable, communicate with reported patients.

The registration of wet cooling towers (De registratie van natte koeltorens)

The Minister of the Environment has asked municipalities to register all wet cooling towers in their territories and to oversee the management and maintenance of cooling towers in practice.

Because the vast majority of cooling towers in the Netherlands are installed at company buildings, the Ministry of Social Affairs and Employment (SZW) is made responsible for *Legionella* control in cooling towers, as far as the risk to employees is concerned. It is assumed that this will also protect the general population. The law does not address registration of these towers in the Netherlands.

Guidance on the cooling tower registration (Procedure Koeltoreninventarisatie EN-Registratie voor gemeenten, oktober 2007, Landelijk Centrum Hygiene en Veiligheid)

This is a procedure for identifying and registering cooling towers in which water mist is released.

It should additionally be mentioned that Jacqueline Cramer, Dutch Minister of Housing, reaffirmed in aletter to the Lower House on 17 April 2007 that workers' protection against *Legionella* infection should be based on the Arbowet.

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[3] Antoine van Hoorn, Legionella Control Program For Cooling and Process Water Systems in an Industrial Plant, Water and Waste water Corus Staal, Environmental Control department, The Netherlands

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4.3.20. Poland

Introduction

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for Poland was 21 (0.1) for 2005 and 89 (0.2) for 2006 [1].

Legislation

Polish legislation places *Legionella* in the group of biological agents that have the potential to affect human health. Legal requirements address the subject of *Legionella* at the workplace, in healthcare units, in the community and in water intended for human consumption. Central and local authorities in the field of labour, health and environment cooperate in keeping exposure to *Legionella* under control.

Poland has harmonised its legislation with European Union Directives and has adopted international standards in its own standardisation system. Council Directive 90/679/EEC on the protection of workers from risks related to exposure to biological agents at work has corresponding legal requirements that are currently enforced. *Legionella* was classified as a pathogen factor according to an Ordinance of the Ministry of Health of 22 April 2005 on the requirements related to the biological factors harmful for health in the environment of work.

Microbiological requirements for hot water according an Ordinance of the Ministry of Health of 29 March 2007 on the requirements for to the quality of water intended for human consumption (Official Journal No. 61, item 417) provides that *Legionella* spp. should be<100 for 100 ml sampling volume. The bacteria shall be tested in hot water in residential buildings and closed healthcare buildings (transposition of Drinking Water Directive).

In closed healthcare buildings in the wards where patients are subject to immunosuppressive treatment, *Legionella* spp. should not be present in water samples of 1,000 ml.

Legionella is subject to the legislation that stipulates mandatory medical examination and general contraindications for workers exposed to biological agents.

Medical examination of exposed workers has to comply with national regulations.

Legionellosis is a disease for which health service providers have to make immediate notification to the local health authority.

Poland has no legal requirements for registering cooling towers.

Standards

Poland has adopted the international standard on Water quality – detection and enumeration of *Legionella*, as PN EN ISO 11731/2008.

Poland has also adopted in its national standardisation system the standard entitled 'Water quality – Enumeration of culturable microorganisms. Colony count by inoculation in a nutrient agar culture medium', as PN EN ISO 6222:2004 intended for the measurement of operational efficiency of the treatment process of public drinking water, applicable also to water in closed containers. EN ISO 6222:2004 deals with microorganisms in general, including *Legionella*. (EN ISO 11731 was published later and was specifically for *Legionella*).

Standard PN EN 806/2002 Specifications for installations inside buildings conveying water for human consumption is also enforced in Poland. Part 2 of the standard mentions that: 'in respect to the prevention of growth of *Legionella* bacteria national or local regulations shall apply'.

Policies

Poland is member of EWGLI and the national collaborator is the Instytut Naukowo-Badawczy (Institute for Scientific Research, Warsaw).

The national authorities involved in legislating for the control of exposure to biological agents, including *Legionella*, are the ***Ministries of Labour and Social Policy, Health, and Environmental Protection, Natural Resources and Forestry***. Regional and local authorities provide guidance and control in applying legal requirements. This multilateral approach leads to more effective control of *Legionella* both at the workplace and in healthcare facilities, hotels and private households.

Research studies are carried out in Poland for *Legionella* detection and clinical diagnosis, as well as regarding legal requirements on this matter.

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5. Nimfa Maria Stojek – Centralny Instytut Ochrony Pracy – Occupational risk to bacteria of genus Legionella
6. PN-EN ISO 11731-2:2008 – Jakość wody – Wykrywanie i oznaczanie ilościowe bakterii z rodzaju Legionella – Część 2: Metoda filtracji membranowej dla wód o małej liczbie bakterii *[Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts (ISO 11731-2:2004) (oryg.)]*
7. PN-EN ISO 6222:2004 – Jakość wody – Oznaczanie ilościowe mikroorganizmów zdolnych do wzrostu – Określanie ogólnej liczby kolonii metodą posiewu na agarze odżywczym *[Water quality – Enumeration of culturable micro-organisms – Colony count by inoculation in a nutrient agar culture medium (ISO 6222:1999)]*
8. Minister of Health – Ordinance of The Ministry of Health of March 29, 2007 on the requirements related to the quality of water intended for human consumption (Official Journal No 61, item 417)
9. Minister of Health – Ordinance of The Ministry of Health of April 22, 2005 on the requirements related to the biological factors harmful for health in the environment of work.

4.3.21. Portugal

Introduction

Legionnaires' disease has been a notifiable disease in Portugal since 1 January 1999, yet outbreaks are rare. An outbreak with 11 cases occurred in September 2000 in northern Portugal, which led to the formation of an outbreak control team consisting of regional, district and local public health professionals. Samples were sent to the National Institute of Health for analysis. A fountain was found to be the most probable cause of the outbreak. Two further outbreaks in 2006 were linked to cooling towers; in one outbreak there were three cases and in the other 21 cases.

Legislation

No legislation is in place for registering cooling towers. The outbreak report for the September 2000 outbreak referred to the Spanish regulations.

Policies

The notification of Legionnaires' disease is addressed in a General Direction of epidemiology department of the Ministry of Health in Lisbon.

4.3.22. Romania

Introduction

According to the Health and Consumers Directorate-General of the European Commission, Romania has not supplied any numbers for legionellosis cases for the period 1997–2006 [1].

The *Report on Occupational Morbidity 1997–2007*, published in 2008 by the Institute for Public Health (Bucharest) presents the incidence of occupational infections but makes no specific reference to *Legionella*-related diseases. [2]. Romania has not yet registered any case of occupational disease caused by exposure to *Legionella*.

The *Report on Transmissible Diseases 2007*, published in 2008 by the National Centre of Communicable Diseases Prevention and Control, shows the existence of one case of legionellosis on Romanian territory [3].

According to the National Centre for the Organisation of the Information System in the Field of Health (Bucharest) one case was reported in 2007 and five cases in 2008 [4].

Legislation

Occupational safety and health (OSH) legislation in Romania is harmonised with EU Directives and is based on the following legal documents:

- The Law for Occupational Safety and Health No. 319 / 2006 [5]
- The Governmental Decisions on specific aspects regarding OSH such as occupational risks, health surveillance, PPE etc.

The Law for Occupational Safety and Health stipulates the obligations of the employers and of the employees (risk assessment, occupational accidents, health surveillance and notification of occupational diseases).

Government Decision HG 1092 / 2006 [6] transposes the EU Directive 2000/54/CE on biological agents.

Government Decision HG 1425/2006 – Norms for the application of OSH Law 319 / 2006 [7], contains in Annex 22 the list of the occupational diseases with mandatory notification. Diseases caused by *Legionella* are not specified as such. However, in the section dedicated to infections and parasitic diseases the list includes 'other infections and parasitic diseases caused by biological agents'. The list of occupational diseases also includes 'air-conditioning and airborne bacteria' as potential causal factors for 'extrinsic allergic bronchoalveolitis'.

Laws No. 458/2002 and 311/2004 [8] regarding the quality of drinking water do not define any admissible limits in the case of *Legionella*. They transpose the EU Directive on drinking water, along with other regulations.

Government Decisions HG 355/2007 and HG 37/2008 [9] regarding workers' health surveillance stipulate compulsory medical examination and contain general precautions for workers exposed to biological agents which also apply to workplaces where *Legionella* might occur.

Government Decision HG 589/2007 [10] provides a methodology for the supervision of transmissible diseases. Legionellosis is a disease for which health service providers (e.g. hospitals) have to notify the local health authorities immediately.

There are no legal provisions for registering cooling towers in Romania, with respect to *Legionella* monitoring and control.

According to order 429/2008 of the Ministry of Health on the 'methodology regarding the approval and implementation of clinical institutional protocols', hospitals have drawn up their own protocols for handling pneumonia cases. The objectives of the protocols are to improve the quality of clinical examination and optimisation of treatment schemes. *Legionella* is included among the biological risk factors considered in the protocol of the Municipal Hospital of Bucharest.

Standards

Romania has adopted the ISO on 'Water quality – detection and enumeration of Legionella', as SR EN ISO 11731/2008 [11]. The standard describes a monitoring method for the isolation and enumeration of *Legionella* in water intended for human use (e.g. hot and cold water used for washing), for human consumption and for treated bathing water (e.g. swimming pools). The method is suitable only for water containing low numbers of bacterial colonies.

Romania has also adopted in its national standardisation system the ISO standard on 'Water quality – Enumeration of culturable microorganisms – colony count by inoculation in a nutrient agar culture medium', as SR EN ISO 6222:2004 [12]. The standard intended is applicable for the measurement of operational efficiency of the treatment process of public drinking water, and for water in closed containers. SR EN ISO 6222:2004 is more general than SR EN ISO 11731.

Standard SR EN 806/2002 [13] 'Specifications for installations inside buildings conveying water for human consumption' in Part 2 mentions that: 'in respect to the prevention of growth of *Legionella* bacteria national or local regulations shall apply'.

Policies

Romania is represented in the European Working Group for Legionella Infections (EWGLI), but is not a signatory to the European Guidelines. The national collaborator in EWGLI is the Institute for Public Health, Timisoara.

The Strategic Plan of the Ministry of Health for 2008–2010 has among its objectives the reduction of the impact of transmissible diseases, including nosocomial infections, on public health.

Legionellosis is a notifiable disease in Romania. Special forms are used for reporting throughout the country in order to obtain unified and complete reports.

Romania has a network for the surveillance of transmissible diseases, which consists of public health district authorities coordinated by the National Centre of Communicable Diseases Prevention and Control. Legionellosis is a priority disease and since 2004 has been progressively introduced into the national health surveillance scheme. At present all patients suffering from pneumonia are submitted to further testing in order to confirm legionellosis diagnosis.

Enhancing public awareness is also part of the national strategy for occupational health and safety and public health. Campaigns are targeted at the general public and they include publications from the Ministry of Health. Air-conditioning and hot water system providers pay provide relevant information on *Legionella* to their clients.

Public health authorities have published methodologies and guidelines for supervising and controlling *Legionella*. The 'Methodology for supervising Legionella pneumonia in hotels', published by the Public Health Authority in Bucharest, describes the symptoms of legionellosis, the sources of exposure and the conditions that favour its development and indications for risk assessment. The document also presents monitoring schemes (sampling and transportation of samples) and measures for the risk mitigation (chemical and physical methods) with a special chapter dedicated to emergency situations [17].

The Public Health Institute in Timisoara has published a guideline titled 'Recommendations on supervising and controlling Legionella sp. infections in Health Care Units'. The document describes the pathogen agent, related diseases and measures for preventing nosocomial infections [18].

References

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[6] HOTARAREA GUVERNULUI ROMANIEI nr. 1.092 din 16 august 2006 privind protecția lucrătorilor impotriva riscurilor legate de expunerea la agenți biologici în munca

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[8] LEGEA nr. 311 din 28 iunie 2004 pentru modificarea şi completarea Legii nr. 458/2002 privind calitatea apei potabile

[9] HOTARAREA GUVERNULUI ROMANIEI nr. 37/2008 pentru modificarea HG nr. 355/2007 privind supravegherea sanatatii lucratorilor

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[11] SR EN ISO 11731-2:2008 – Calitatea apei. Detecția şi numărarea Legionella. Partea 2: Metoda prin filtrare directă pe membrană, pentru ape cu conținut scăzut de bacterii (ISO 11731-2:2004 – Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts)

[12] SR EN ISO 6222:2004 – Calitatea apei. Numărarea microorganismelor de cultură. Numărarea coloniilor prin însămânțare în mediu de cultură agar (ISO 6222:1999 – Water quality – Enumeration of culturable microorganisms – Colony count by inoculation in a nutrient agar culture medium)

[13] SR EN 806-1:2002 – Specificații tehnice referitoare la instalații de distribuție a apei destinată consumului uman în interiorul clădirilor. Partea 1: Generalități (Specifications for installations inside buildings conveying water for human consumption – Part 1: General)

[14] HOTARAREA GUVERNULUI ROMANIEI nr. 1.048 din 9 august 2006 privind cerințele minime de securitate şi sănătate pentru utilizarea de către lucrători a echipamentelor individuale de protecție la locul de munca

[15] SR EN 806-3:2006 – Specificaţii tehnice referitoare la instalaţii de distribuţie a apei destinată consumului uman în interiorul clădirilor. Partea 3: Calcularea diametrelor interioare. Metodă simplificată (Specifications for installations inside buildings conveying water for human consumption – Part 3: Pipe sizing – Simplified method)

[16] Ordinul MS nr. 860/2004 privind aprobarea Listei bolilor transmisibile prioritare in România

[17] Institutul De Sănătate Publică Bucuresti – Centrul Pentru Prevenirea Si Controlul Bolilor Transmisibile – Metodologia de supraveghere a pneumoniilor cu Legionella

[18] Institutul De Sănătate Publică ,,Prof. Dr. Leonida Georgescu' Timişoara – Centru Colaborator EWGLI – Recomandări privind supravegherea si controlul infecțiilor cu *L. pneumophila* in unitățile sanitare

4.3.23. Slovakia

Introduction

Surveillance of legionellosis and international reporting in Slovakia were set up in 1990. The incidence in Slovakia is the lowest in Europe; there have been no epidemics and no travel-related legionellosis has yet been detected. Since 1985 only 48 sporadic cases (31 males, 17 females) of mean age of 45.6 years (14–83 years) have been detected. Except in the years 1986 and 1988, 1–7 cases were notified per year, mostly in inpatients suffering from pneumonia or pleuropneumonia, showing a morbidity rate of 0.2–1.3/million. Two patients died, one in causal association. The highest number of patients was in the age group 40–49 years. According to the epidemiological analysis, all infections were acquired in the community, and only one case may have been acquired abroad. Eighteen cases were inpatients in hospitals with positive *Legionella* colonisation in Bratislava and Trenčin, one case of suspect nosocomial origin [1].

Legislation

The Slovak Republic has no specific legislation about *Legionella* prevention. General preventive measures are prescribed in legislation concerning the quality of drinking water. Water quality has been monitored and evaluated on the basis of government regulations since 2006.

The Directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work was transposed into the Slovak legislation by governmental decree No. 47/2002 On the protection of health at work from biological agents (47/2002 Z.z. o ochrane zdravia pri práci s biologickými faktormi).

Standards

Standard STN 83 0616, 'Hot water quality', defines the biological and bacteriological indicators of drinking water quality.

The main health risks from hot water are pathogenic and conditionally pathogenic bacteria able to multiply in warm water.

Standard STN EN ISO 11731-2:2008: 'Water quality. Detection and enumeration of *Legionella*. Direct membrane filtration method for waters with low bacterial counts.'

Policies

Slovakia is a member of EWGLI and the national collaborator is the Institute of Epidemiology, Faculty of Medicine, Bratislava.

References

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4.3.24. Slovenia

Introduction

Legionnaires' disease was first detected in Slovenia in 1991, when 17 health workers fell ill in Jesenice hospital. In Slovenia cases of Legionnaires' disease are rare, with 39 cases reported between 1987 and 1998. According to the Institute for the Protection of Health three fatal cases of Legionnaires' disease were reported in 1996 and 1997. Between 1986 and 1996, 46 patients were treated and they were predominantly infected outside hospitals.

The data indicate that between 1999 and 2006 about 14% of all registered patients with legionellosis were staying in resorts that provided thermal baths or spas.

Legislation

Regulation on the ventilation and air-conditioning of buildings (Applicable from 2002) (Pravilnik o prezračevanju in klimatizaciji stavb) (velja od 2002).

This regulation specifies the technical requirements for ventilation and air-conditioning of buildings and the technical requirements for mechanical ventilation systems. This document deals with the internal environment (air quality and thermal environment).

Ventilation systems must be designed, installed and maintained so that growth of microorganisms is not possible in any components of the system. The total number of aerobic bacteria in the water in a moisturising chamber should not be more than 1,000 CFU (colony-forming units) in 1 ml of water at the incubation temperature of 22 ±2 ºC for 68 ±4 hours and 36 ±2 ºC for 44 ±4 hours. *Legionella* bacteria should not be present in a humidifying chamber.

The quantity of bacteria in a water humidification chamber must be checked at least twice a year.

Regulation about minimum health and other requirements for bathing waters (Applicable from 2003, changed 2006) (Pravilnik o minimalnih higienskih in drugih zahtevah za kopalne vode) (velja od 2003, spremenjen 2006)

This regulation specifies the minimum hygiene requirements for bathing water in swimming pools, natural swimming pools and other bathing areas, their assessment and monitoring for the protection of the users' health. The water of swimming pools and beaches should not contain microorganisms, parasites or substances in a concentration that, alone or in combination with other substances, presents a health risk for users. *Legionella pneumophila* should not be present in the bathing water.

Decree for the protection of workers from risks related to exposure to biological agents at work (Applicable from 2002, changed 2005) (Pravilnik o varovanju delavcev pred tveganji zaradi izpostavljenosti biološkim dejavnikom pri delu) (veljaven od 2002, dopolnjen 2005). Directive 2000/54/EC for the protection of workers from risks related to exposure to biological agents at work was transposed into Slovene legislation with this decree.

Standards

SIST EN ISO 11731 Water quality – detection and enumeration of *Legionella*

SIST EN ISO 11731-2 Water quality – detection and enumeration of *Legionella* – part 2: Direct membrane filtration method for waters with low bacteria counts.

Policies

Slovenia is a member of EWGLI and the national collaborator is the Institute of Public Health, Ljubljana.

National communicable disease surveillance, prevention and control in Slovenia is coordinated by the Centre for Communicable Diseases of the Institute of Public Health of the Republic of Slovenia (Center za nalezljive bolezni Inštituta za varovanje zdravja Republike Slovenije).

4.3.25. Spain

Introduction

The Ministry of Health and Consumer Affairs [1, 2, 3] created the National Epidemiological Monitoring Network through the Royal Decree 2210/1995, dated 28 of December (BOE, official gazette of spanish government, of 24 January). In this Decree, Legionnaires' disease is declared a notifiable disease.

Between 1989 and 2005, 310 outbreaks of the disease were reported to the Network, which resulted in 2,974 cases. In addition to these, the European Working Group for *Legionella* Infections (EWGLINET) announced another 67 groups of cases. These groups involved 230 individuals affected during a visit in Spain (Table 7).

Table 7: Number of outbreaks and affected cases reported to the National Epidemiological Monitoring Network, Spain (1989–2005)

					Travels				Total	
	Intercommunal acquired		Hospital-acquired		EWGLINET		Spanish people			
Years	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
1989	0	0	1	7	1	12	1	8	**3**	**27**
1990	1	6	0	0	3	38	2	9	**6**	**53**
1991	2	93	0	0	1	2	2	5	**5**	**100**
1992	0	0	0	0	0	0	1	3	**1**	**3**
1993	3	64	0	0	2	7	4	29	**9**	**100**
1994	2	35	2	10	1	2	1	2	**6**	**49**
1995	0	0	1	15	0	0	0	0	**1**	**15**
1996	1	224	0	0	3	11	0	0	**4**	**235**
1997	0	0	3	21	7	17	0	0	**10**	**38**
1998	2	8	2	11	8	26	1	2	**13**	**47**
1999	8	78	2	8	3	8	2	54	**15**	**148**
2000	12	243	5	28	8	26	1	2	**26**	**299**
2001	19	716	6	41	6	17	3	9	**34**	**783**
2002	46	360	6	29	5	11	8	25	**65**	**425**
2003	39	212	2	10	8	26	10	33	**59**	**281**
2004	37	190	2	8	6	13	7	15	**52**	**226**

					Travels				Total	
	Intercommunal acquired		Hospital-acquired		EWGLINET		Spanish people			
Years	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
2005	56	331	1	9	5	14	6	21	**68**	**375**
Total	**228**	**2,560**	**33**	**197**	**67**	**230**	**49**	**217**	**377**	**3,204**

Source: Carlos III Institute for Health

Out of the 310 outbreaks, 228 (2,560 cases) were inter-communally derived, 33 (197 cases) were detected in patients within hospitals and 49 (217 cases) occurred among Spanish tourists while travelling within the country. The average size of the outbreaks and mortality differed from area to area. The total mortality rate was 4.6% (Table 8). As expected, the rate of cases within hospitals was greater (26.6%) than those within the community (1.3%) or those for tourists (7.6%). Differences in the percentage of the outbreaks were observed for the tourist groups (EWGLINET: 9.8% – Spanish tourists: 3.6%).

Table 8: **Number of outbreaks reported, average size of outbreaks and mortality, Spain (1989–2005)**

Group	Number of outbreaks	Average of cases	Deaths	Mortality
Hospital-acquired	33	6.0 (2–19)	50	24.6%
Tourists EWGLINET*	67	3.4 (2–26)	24	9.8%
Spanish tourists **	49	4.4 (2–43)	10	3.6%
Intercommunal acquired	228	11.2 (2–650)	76	1.3%
Total	337	8.5 (2–650)	160	4.6

(*) Outbreaks of Legionnaires' disease reported to EWGLINET referring to foreign travellers in Spain
(**) Outbreaks of Legionnaires' disease reported to EWGLINET referring to Spanish travellers in Spain

Source: Carlos III Institute for Health

According to the provisional annual report of the Carlos III Institute for Health, on 1,232 cases of Legionnaires' disease in total were reported in Spain in 2008. This was an increase on 2007, when 1,178 cases were reported.

Spain is a member of the European Working Group for Legionella Infections (EWGLINET) whose mission is to monitor travel-related cases of Legionnaires' disease. In total, the disease infected 143 individuals during their stay in Spain in 2008.

The most frequently identified sources of infection are presented in Table 9. It is difficult to find a source of infection related epidemiologically and/or microbiologically to the outbreaks. This becomes obvious from the fact that in many outbreaks (42.2%) the source of infection was not detected. Cooling towers were the cause of 72 outbreaks (33% of the total outbreaks of which the source of infection was detected).

Table 9: **Most frequently identified sources of infection of outbreaks of Legionnaires' disease and cases per outbreak, Spain (1989–2005)**

	Outbreaks (%)	Cases
Sanitary water facilities for buildings	93 (24.7)	449
Cooling towers	72 (19.1)	1.727
Spa baths / whirlpools	7 (1.8)	72
Others	7 (1.8)	32
Negative results	*39 (10.3)*	*168*
Unidentified	*159 (42.2)*	*756*
Total	**377 (100)**	**3,204**

Source: Carlos III Institute for Health

Inspections have determined that a lack of chlorine is the most frequent cause of the outbreaks. Cleanliness and chlorination are the most effective measures for the control of outbreaks.

Legislation [5]

The Public Health Commission of the Interterritorial Council of the National System of Health (Comisión de Salud Pública del Consejo Interterritorial del Sistema Nacional de Salud) met on 29 October 1999 to discuss the prevention and control of Legionnaires' disease. It decided to develop technical criteria that would be acceptable to the national health authorities as well as those of Spain's autonomous and local administrations. This resulted in Royal Decree 909/2001, dated 27 July, which consolidates hygiene measures for the prevention and control of Legionnaires' disease.

This law also allows the autonomous communities to make it obligatory for the managers of installations such as heated swimming pools and cooling towers to carry out periodic checks to avoid a new outbreak of the disease.

Details of how to clean, disinfect and maintain these installations is given in the Guide UNE 100-030-94 'Guide for the prevention of Legionnaires' disease in installations' (UNE 100-030-94 'Guía para la prevención de la *Legionella* en instalaciones'). Other sanitary measures for monitoring, microbiological control and possible closure of the installations in which cases or outbreaks of legionellosis have been reported, are found in a publication of the Ministry of Health and Consumer Affairs 'Recommendations for the prevention and control of Legionnaires' disease' ('Recomendaciones para la prevención y control de legionelosis').

Progress in scientific and technical knowledge and the accumulated experience gained from the application of Royal Decree 909/2001 resulted in the cancellation of the decree and the approval of a new norm that includes updated measures for more efficient control of Legionnaires' disease: Royal Decree 865/2003, passed on 4 July 2003 [6]. This regulation considers factors that promote the proliferation of Legionnaires' disease, as well as the possible procedures for eliminating it in an easy and effective way. The installations implicated in outbreaks or cases are also classified according to the probability of proliferation and dispersion of the disease. The regulation promotes and the use of renewable energy sources, which improve the efficiency of the installations.

Autonomous communities have specific measures in place to prevent the spread of Legionnaires' disease through air-conditioning systems.

Madrid's Council of Health and Social Services published the first such measure on 11 June 1998, following an outbreak in Alcala de Henares in 1996, where 11 people died and 246 fell ill [7]. This ordinance stresses that chlorination is the best treatment for the disinfection of air-conditioning systems and other installations.

Following repeated reports of Legionnaires' disease recorded by Alcoy Hospital in Valencia, the local Council of Health promulgated a decree, in December 2000, concerning hygiene standards in air-conditioners that emit aerosols [8].

In December 2000, after an outbreak of Legionnaires' disease in Barcelona that affected 49 inhabitants, the Catalan autonomous government was forced to bring in new legislation on technical and sanitary conditions for air-conditioning apparatus [9].

In January 2001 Galicia published a decree that regulates the standards of cleanliness for the prevention of contamination by *Legionella* in thermal installations [10].

In La Rioja, Royal Decree 664/1997 concerns protection from exposure to biological agents during work, and concentrates on protective measures against *Legionella* in the workplace.[11]

Further legislation from the Spanish government and autonomous communities can be found in Annex I, below.

Standards

The Spanish Association for Standardisation and Certification is called AENOR [12]. It is an organisation dedicated to the development of standardisation and certification in all industrial and service sectors.

Concerning *Legionella*, the following standards are in effect:

UNE-EN ISO 11731-2:2008 (ISO 11731-2:2004) and UNE-ISO 11731:2007 (ISO 11731:1998) concerning water quality and the detection and enumeration of *Legionella*. Part 2 of the first (2008) standard concerns a direct membrane filtration method for water that has low bacterial counts. UNE 100030:2005 IN is a *guidance for the prevention and control of Legionella.* This standard replaced UNE 100030:2001 IN (same title).

A new standard is being developed: (PNE-prEN 13623), relating to chemical disinfectants and antiseptics. It includes a quantitative suspension test for the evaluation of bactericidal activity against *Legionella pneumophila* of chemical disinfectants for aqueous systems and a test method and requirements (phase 2, step 1).

Policies

As a result of Royal Decree 2210/95 [13] the National Epidemiological Monitoring Network was created [1]. Following this, in 1996, Legionnaires' disease was added to the list of notifiable diseases at national level. When a case of Legionnaires' disease is suspected, doctors are expected to report it. Notification is done on a weekly basis and must be accompanied by microbiological and epidemiological data that identify the disease, all gathered in agreement with the protocols relating to notifiable diseases. The Network's objective is to recognise trends in the incidence of the disease and its possible transmission in the community, through the detection of sporadic cases, outbreaks and related cases that allow the identification of the infection sources and the use of suitable control measures [14].

Notification of outbreaks and epidemics

Reporting of an outbreak of Legionnaires' disease is compulsory and should be done immediately through the National Epidemiological Monitoring Network. At the end of the outbreak the officials responsible for monitoring the cases must report their findings within three months to the National Epidemiologic Centre.

Microbiological Information System

This system is based on reports from cases of Legionnaires' disease identified in microbiological laboratories in hospitals. According to Royal Decree 2210/95, reporting to the Microbiological Information System is now compulsory and is part of the basic system for epidemiological monitoring followed in Spain's autonomous communities.

Reporting cases of Legionnaires' disease in travellers within Europe

Spain is a member of the European Working Group for Legionella Infections (EWGLINET). The collaborator of EWGLINET is the Carlos III Health Institute (Sección de Información Microbiológica, Centro Nacional de Epidemiología, Instituto de Salud Carlos III). The members of the group are obliged to report any cases of the disease in any Spanish people that travel overseas and in turn the group has to inform Spain about tourists who are suspected to have transmitted the disease in Spain.

Information derived from the National Microbiological Centre (Instituto de Salud Carlos III) [14]

The Legionella Laboratory of the National Microbiological Centre functions as a reference laboratory for the whole country. This helps to isolate the *Legionella* microorganism from other clinical or environmental samples. In the event of the appearance of the disease the laboratory conducts identification procedures for other microorganisms to help pin down the source of the infection. In addition, the Centre's Microbiological Diagnostic Service studies serum samples of patients with respiratory diseases.

The Spanish government and the governments of some autonomous communities have published guidelines for owners of relevant installations, maintenance technicians and all professionals involved in the prevention and control of Legionnaires' disease:

- Recommendations for the prevention and control of Legionnaires' disease **(Recomendaciones para la prevención y control de la legionelosis) [15]**
- Manual for the prevention and control of Legionnaires' disease, aspergillosis and tuberculosis in medical installations **(Manual para la prevención y control de la legionelosis, aspergilosis y tuberculosis en instalaciones sanitarias) [16]**
- Manual for the prevention and control of Legionnaires' disease in installations suspected of Legionella **(Manual para la prevención y control de la legionelosis en instalaciones de riesgo) [17]**
- Technical guide for the prevention and control of Legionnaires' disease in installations **(Guía técnica para la prevención y control de la legionelosis en instalaciones) [18]**
- Practical guide for the design of an auto control plan for Legionnaires' disease **(Guía práctica para el diseño del plan de autocontrol de Legionella) [19]**

References

[1] Ministerio de Sanidad y Consumo: http://www.msc.es/ciudadanos/saludAmbLaboral/docs/vigilancia_legionella.pdf

[2] Ministerio de Sanidad y Consumo: http://www.msc.es/ciudadanos/saludAmbLaboral/agenBiologicos/guia.htm

[3] Ministerio de Sanidad y Consumo: http://www.msc.es/ciudadanos/saludAmbLaboral/docs/accpreventivas_legionella.pdf

[4] http://www.higieneambiental.com/tratamiento-de-aguas-y-legionella/prevalencia-de-legionelosis-en-espana-en-2008

[5] http://hispagua.cedex.es/documentacion/especiales/legionella.php?localizacion=Sobre%20la%20Legionella

[6] Real Decreto 865/2003, de 4 de julio, por el que se establecen los criterios higiénico-sanitarios para la prevención y control de la legionelosis: http://www.boe.es/aeboe/consultas/bases_datos/doc.php?coleccion=iberlex&id=2003/14408&txtlen=1000

[7] *(ORDEN 1187/1998, de 11 de junio, de la Consejería de Sanidad y Servicios Sociales de la Comunidad de Madrid por la que se regulan los criterios higiénico-sanitarios que deben reunir los aparatos de transferencia de masa de agua en corriente de aire y aparatos de humectación para la prevención de la Legionelosis*

[8] *(DECRETO 173/2000 de 5 de diciembre, del Gobierno Valenciano, por el que se establecen las condiciones higiénico-sanitarias que deben reunir los equipos de transferencia de masa de agua en corriente de aire con producción de aerosoles, para la prevención de la legionelosis. [DOGV Nº. 3893 DE 07.12.2000]*

[9] DECRETO 417/2000, de 27 de desembre, pel qual s'estableixen amb caràcter d'urgència les condicions tecnicosanitàries aplicables als aparells i equips de transferència de massa d'aigua en corrent d'aire amb producció d'aerosols per a la prevenció de la legionel.losi
[10] Decreto 9/2001, do 11 de xaneiro polo que se regulan os criterios sanitarios para a prevención da contaminación por legionella nas instalacións térmicas
[11] (REAL DECRETO 664/1997, de 12 de mayo, protección de los trabajadores contra los riesgos relacionados con la exposición a agentes biológicos durante el trabajo
[12] Asociación Española de Normalización y Certificación: http://www.aenor.es/desarrollo/inicio/home/home.asp
[13] Ministerio de la Presidencia, Boletín Oficial del Estado: http://www.boe.es/boe/dias/2003/07/18/pdfs/A28055-28069.pdf
[14] Instituto de Salud Carlos III, Centro Nacional de Epidemiología: http://www.isciii.es/htdocs/centros/epidemiologia/Epi_legionelosis.jsp
[15] Ministerio de Sanidad y Consumo- Dirección General de Salud Pública: http://www.uib.es/depart/dba/microbiologia/ABF/Legionelosis.pdf
[16] Junta de Andalucia – Consejería de Salud: http://www.juntadeandalucia.es/salud/library/plantillas/externa.asp?pag=../../contenidos/institucional/sanidad%20ambiental/guias/inicio.pdf
[17] Comunidad de Madrid: http://www.checklistlegionella.com/pdfs/guia_madrid.pdf
[18] Suddirección General de Sanidad Ambiental y Salud Laboral – Técnicos de Sanidad Ambiental de las Comunidades Autónomas: http://www.higieneambiental.com/index.php?option=com_content&task=view&id=53&Itemid=119
[19] Gobierno Vasco – Departamento de Sanidad: http://www.osasun.ejgv.euskadi.net/r52-publ01/es/contenidos/informacion/sanidad_ambiental/es_1249/adjuntos/legionella/planAutocontrol_c.pdf
[20] http://www.mjcservicios.com/normativa_legionella.html

Annex – National and regional legislation [20]

Normativa y legislacion nacional sobre Legionella Gobierno de España

Real Decreto 909/2001, de 27 de julio, por el que se establecen los criterios higiénico-sanitarios para la prevención y control de la legionelosis.

se ha aprobado por el Consejo de Ministros el 27/07/2001

Real Decreto 865/2003, de 4 de julio, por el que se establecen los criterios higienico-sanitarios para la prevencion y control de la legionelosis. [BOE núm. 171 del 18.07.2003]

Orden SCO/317/2003, de 7 de febrero, por la que se regula el procedimiento para la homologación de los cursos de formación del personal que realiza las operaciones de mantenimiento higiénico-sanitario de las instalaciones objeto del RD 909/2001, de 27 de junio. [BOE núm 44 de 20.02.2003]

Real Decreto 1054/2002, de 11 de octubre, por el que se regula el proceso de evaluación para el registro, autorización y comercialización de biocidas. [BOE nº 247 del 15.10.2002]

Guia tecnica para la Prevencion y Control de la Legionelosis en instalaciones UNE 100-030-94

La publicación del Ministerio de Sanidad y Consumo '**Recomendaciones para la prevención y control de legionelosis**'

Real Decreto 664/1997, de 12 de Mayo, sobre la protección de los trabajadores contra los riesgos relacionados con la exposición a agentes biológicos durante el trabajo.

Orden SCO/3269/2006, de 13 de octubre, por la que se establecen las bases para la inscripción y el funcionamiento del Registro Oficial de Establecimientos y Servicios Biocidas.

Real Decreto 363/1995, de 10 de marzo, por el que se aprueba el Reglamento sobre notificación de sustancias nuevas y clasificación, envasado y etiquetado de sustancias peligrosas.

Real Decreto 140/2003, de 7 de febrero, por el que se establecen los criterios sanitarios de la calidad del agua de consumo humano.

Real Decreto 255/2003, de 28 de febrero, por el que se aprueba el Reglamento sobre clasificación, envasado y etiquetado de preparados peligrosos.

Real Decreto 1027/2007, de 20 de julio, por el que se aprueba el Reglamento de Instalaciones Térmicas en los Edificios (RITE).

Normativa **Comunitat Valenciana** sobre *Legionella*

ROESB. **Decreto 96/2004, de 11 de junio,** del Consell de la Generalitat, por el que se crea el Registro Oficial de Establecimientos y Servicios Biocidas de la Comunidad Valenciana [DOGV núm. 4.782 de 24.06.2004]

Orden conjunta de 22 de febrero de 2001, de las Consellerías de Medio Ambiente y Sanidad, por la que se aprueba el protocolo de limpieza y desinfección de los equipos de transferencia de masa de agua en corriente de aire con producción de aerosoles, para la prevención de la legionelosis. [DOGV núm. 3.948 de 27.02.2001]

Decreto 173/2000 de 5 de diciembre de 2000, del Gobierno Valenciano, por el que se establecen las condiciones higiénico-sanitarias que deben reunir los equipos de transferencia de agua en corriente de aire con producción de aerosoles, para la prevención de la legionelosis. [DOGV – Núm. 3.893 de 07.12.2000]

Decreto 201/2002, de 10 de diciembre, del Consell de la Generalitat, por el que se establecen medidas especiales ante la aparición de brotes comunitarios de legionelosis de origen ambiental. ZAE (Zonas de Actuación Especial).

Orden de 7 de mayo de 1986, de la Conselleria de Sanidad y Consumo, determinando normas mínimas de tratamiento sanitario de los establecimientos hoteleros y alojamientos turísticos.

Normativa **Región de Murcia** sobre *Legionella*

Aunque en la comunidad murciana no existe legislación sobre análisis de estas torres de refrigeración, sí existe un protocolo de normas de mantenimiento y examen de esas instalaciones. Esa norma no es de obligado cumplimiento.

Ordenanza de protección de la atmósfera del Ayuntamiento de Murcia. (Artículo 28. Instalaciones de refrigeración en edificios de usos colectivos e industrias)

Analíticas mínimas a realizar en residencias de personas mayores

Normativa Aragon sobre *Legionella*

Decreto 136/2005, de 5 de julio, del Gobierno de Aragón, por el que se establecen medidas especiales para la prevención y control de la legionelosis.

Decreto 87/2005, de 26 de abril, del Gobierno de Aragón, por el que se crea el Registro Oficial de Establecimientos y Servicios Biocidas de la Comunidad Autónoma de Aragón

Orden de 1 de marzo de 2004, del Departamento de Salud y Consumo, por la que se establecen medidas referidas al censo de instalaciones, aparatos y equipos de riesgo en relación con la legionelosis.

Correción de errores de la Orden de 1 de marzo de 2004, del Departamento de Salud y Consumo, por al que se establecen medidas referidas al censo de instalaciones, aparatos y equipos en relación con la legionelosis.

Normativa **Govern Illes Balears** sobre *Legionella*

Decreto 81/2005, de 22 de julio, por el cual se regula el procedimiento de autorización, vigilancia y control de los cursos para formar al personal que realiza las operaciones de mantenimiento higiénico y sanitario de las instalaciones de riesgo de legionelosis.

Comunidad de Andalucía

Decreto 287/2002, de 26 de noviembre, por el que se establecen medidas para el control y la vigilancia higiénico-sanitarias de instalaciones de riesgo en la transmisión de la legionelosis y se crea el Registro Oficial de Establecimientos y Servicios Biocidas de Andalucía (BOJA n° 144 de 7-12-2002).

Comunidad de Catalunya

Decreto 352/2004, de 27 de julio, por el que se establecen las condiciones higiénico-sanitarias para la prevención y el control de la legionelosis (DOGC número 4185, de 29 de julio de 2004).

Decret 417/2000, de 27 de desembre, pel qual s'estableixen amb caràcter d'urgència les condicions tecnicosanitàries aplicables als aparells i equips de transferència de massa d'aigua en corrent d'aire amb producció d'aerosols per a la prevenció de la legionel.losi.

Comunidad de Madrid

Real Decreto 909/2001, de 27 de julio, por el que se establecen los criterios higiénico-sanitarios para la prevención y control de la legionelosis.

Orden 1187/1998, de 11 de junio, de la Consejería de Sanidad y Servicios Sociales de la Comunidad de Madrid, por la que se regulan los criterios higiénico-sanitarios que deben reunir los aparatos de transferencia de masa de agua en corriente de aire y aparatos de humectación para la prevención de la Legionelosis. (BO. Comunidad de Madrid 19 junio 1998, núm. 144).

Orden SCO/317/2003, de 7 de febrero, por la que se regula el procedimiento para la homologación de los cursos de formación del personal que realiza las operaciones de mantenimiento higiénico-sanitario de las instalaciones objeto del Real Decreto 909/2001, de 27 de julio.

Real Decreto 1054/2002, de 11 de octubre, por el que se regula el proceso de evaluación para el registro, autorización y comercialización de biocidas.

Orden 809/1994, de 15 de junio, de la Consejería de Economía y de la Consejería de Salud sobre inscripción y funcionamiento del Registro Oficial de Establecimientos y Servicios Plaguicidas. El listado de todas las empresas inscritas en el citado Registro puede encontrarlo en: http://www.madrid.org/plaguicidas.

Real Decreto 140/2003, de 7 de febrero, por el que se establecen los criterios sanitarios de la calidad del agua de consumo humano

Galicia

Decreto 9/2001, do 11 de xaneiro polo que se regulan os criterios sanitarios para a prevención da contaminación por legionella nas instalacións térmicas

La Rioja

La Rioja se recoje en el **Real Decreto 664/1997, de 12 de mayo,** protección de los trabajadores contra los riesgos relacionados con la exposición a agentes biológicos durante el trabajo, medidas de protección frente a la *Legionella* en el ámbito del trabajo

Recopilación de legislacion vigente de prevencion de legionelosis aplicable en Navarra

Real Decreto 865/2003, de 4 de julio, por el que se establecen los criterios higiénico-sanitarios para le prevención y control de la legionelosis.

Orden SCO 317/2003, de 7 de febrero, por la que se regula el procedimiento para la homologación de los cursos de formación del personal que realiza las operaciones de mantenimiento higiénico-sanitario de las instalaciones objeto del Real Decreto 909/2001, de 27 de julio

Decreto Foral 298/2001, de 15 de octubre, por el que se dictan normas para la aplicación en Navarra del Real Decreto 909/2001, de 27 de julio, por el que se establecen los criterios higiénico-sanitarios para la prevención y control de la legionelosis.

Decreto Foral 54/2006, de 31 de julio, por el que se establecen medidas para la prevención y control de la legionelosis.

Orden Foral 37/2003, de 9 de abril, por el que se regula el procedimiento de homologación de los cursos de formación del personal que realiza las operaciones de mantenimiento higiénico-sanitario de las instalaciones de riesgo frente a *Legionella*.

Extremadura

Orden de 11 de junio de 2001, por la que se regulan los criterios higiénico-sanitarios que deben reunir los aparatos de transferencia de masa de agua en corriente de aire y aparatos de humectación para la prevención de la legionelosis.

Castilla la Mancha

Orden de 18-09-2001, de la Consejería de Sanidad, sobre prevención de la legionelosis y de modificación de la Orden de la Consejería de Sanidad, de 30 de julio de 1993.

Asturias

Decreto 90/2002, de 4 de julio, sobre medias complementarias relativas a las instalaciones de riesgo y empresas de mantenimiento en relación con la prevención de la legionelosis.

Cantabria

Decreto 122/2002, de 10 de octubre, por el que se regulan los criterios higiénico-sanitarios que deben reunir los equipos de transferencia de masa de agua en corriente de aire con producción de aerosoles y aparatos de humectación, para la prevención de la legionelosis.

Other legislation

Real Decreto 1138/1990, de 14 de Septiembre, por el que se aprueba la reglamentación técnico sanitaria para el abastecimiento y control de calidad de las aguas potables de consumo público

http://hispagua.cedex.es/bbdd/Legis/Textos/Estado/845.pdf

Decisión de la Comisión de 22 de diciembre de 1999 relativa al sistema de alerta precoz y respuesta para la vigilancia y control de las enfermedades transmisibles en aplicación de la Decisión n o 2119/98/CE del Parlamento Europeo y del Consejo.(2000/57/CE)
http://www.cde.ua.es/dsi/elpdf/l_02120000126es00320035.pdf

Decisión de la Comisión de 22 de diciembre de 1999 relativa a las enfermedades transmisibles que deben quedar progresivamente comprendidas en la red comunitaria,en aplicación de la Decisión n o 2119/98/CE del ParlamentoEuropeoy del Consejo. (2000/96/CE)
http://www.cde.ua.es/dsi/elpdf/l_02820000203es00500053.pdf

Directiva 80/778/CEE del Consejo, de 15 de julio de 1980, relativa a la calidad de las aguas destinadas al consumo humano.
http://hispagua.cedex.es/bbdd/Legis/Textos/Europa/866.htm

Directiva 98/83/CE del Consejo de 3 de noviembre de 1998 relativa a la calidad de las aguas destinadas al consumo humano. http://hispagua.cedex.es/bbdd/Legis/Textos/Europa/881.htm

4.3.26. Sweden

Introduction

In Sweden at least 500 people are estimated to fall ill with Legionnaires' disease each year. Approximately one out of ten who fall ill dies from the disease. The most common reasons are lack of correct diagnosis and the fact that *Legionella* bacteria do not react to the usual medical treatment of pneumonia. In most cases, the victims are people whose resistance is reduced by smoking, old age, ill health or other medical treatments.

Legislation

Sweden's legislation is more general than that of many other countries. In Sweden *Legionella* is mentioned in the law for infectious diseases control, the environmental law and the building regulations [4].

Legislation on the Working Environment

The Work Environment Act (1977:1160), passed by the Parliament in 1977, came into force on 1st July 1978. It has been amended several times since then.

The Government has issued a Work Environment Ordinance containing certain supplementary rules.

In the case of Legionella the provisions (AFS 2005:1) on Microbiological Work Environment Risks – Infection, Toxigenic Effect, Hypersensitivity (available in English at www.av.se) are the base for the Swedish Work Environment Authority to demand actions from employers. These provisions are the implementation of the EU directive 2000/54/EC. Employers are obliged to perform a risk assessment when there is a risk for communicable diseases to spread to the employees. Following this risk assessment and considerations necessary protective measures shall be taken according to the nature of the work. Constructors also have responsibilities according to the provisions of the Swedish Work Environment Act and the provisions.

In the provisions (AFS 2009:2) on Design of the Workplace there are specific demands to prevent the spread of Legionella. 'Showers shall be designed in order to prevent growth and spread of Legionella bacteria.' There is also stated that fresh air intake shall be appropriately positioned with regard to outdoor air pollution levels. It should for example be taken into account that where cooling towers are located, there is a risk of spread of Legionella bacteria if the aerosol from the cooling tower is drawn into the ventilation system of a workplace.

On state level as well as on local (regional) level the Swedish Work Environmental Authority has the role of supervisor of workplaces [1,2,3].

Wet cooling systems

Sweden does not have legislation for registering wet cooling systems and has no fixed action values for cooling tower water.

Building legislation

According to the Swedish Building Regulations [5] issued by the National Board of Housing, Planning and Building (Boverket), all cold and hot water installations in new buildings must be constructed so that *Legionella* bacteria and other microorganisms cannot multiply and reach hazardous levels. The materials used and the requirements of water systems design are the builders' responsibility. Requirements regarding water supply systems are given in Boverket's Building Regulations Clauses 6:61 and 8:42. Requirements regarding the quality of drinking water are set out in the Ordinance on Drinking water from the National Food Administration, SLV FS 1989:30, H318.

For existing buildings, the regulations that were in force at the time they were constructed are applicable. This means that current regulations regarding water temperatures, among other things,

are not mandatory for buildings constructed earlier than 1994. However, for building modifications and renovations the new regulations are valid.

The person who is doing the building, or has hired someone to do the building, is responsible for meeting these legal requirements.

The client (owner of the building) is responsible for maintaining the building and its installations so that it functions as intended.

Environmental Code (1998:808)

Several authorities have supervision on state level according to this legislation. The Swedish Environmental Protection Agency is one of them. Another one is the Swedish Board of Health and Welfare. On community level the Environment and Public Health Committee is supervisory authority. *The Environment and Public Health Committee* is the supervisory hygiene authority. It provides information on applicable rules. The Committee may also intervene directly and take action against the person who owns or rents a dwelling or premises.

According to the Environmental Law the water system, irrespective of its age, must not be a health hazard for those who live in the building.

The Swedish Communicable Diseases Act

According to the Communicable Diseases Act, 2004,*Legionella* infection is a notifiable disease. The Supervisory authority on state level is the Swedish Board of Health and Welfare. On regional level the County Medical Officer is responsible for control of communicable diseases and if there is a case of Legionella in the region it must be reported to him. [6].

Standards

SS-EN ISO 11731-2:2008 'Vattenundersökningar – Bestämning av Legionella – Del 2: Membranfiltermetod för vatten med lågt antal bakterier (ISO 11731-2:2004)'.

Policies

Sweden follows the policy developed by the European Working Group for Legionella Infections (EWGLI).

The *Swedish Work Environment Authority* is responsible for the supervision of employers and constructers of workplaces on state, regional and local level. Legionella has been paid attention to on the website, www.av.se, in the case of Legionella in biological treatment plants at paper mills and on mist distribution in food stores among other things. The information is in Swedish.

The local Building Committees are the supervisory authorities for building legislation and they provide information on the applicable rules for every case. The Committee may intervene if the provisions in the building regulations are not met.

The National Board of Housing, Building and Planning (Boverketis) is responsible for the general supervision of planning and building activities and controls the implementation of the building legislation. The Board has the right to issue technical requirements for construction works and installations.

The National Board of Health and Welfare is responsible for general supervision in accordance with the Environmental Law. The Board must also evaluate, follow up and coordinate the advisory service and support the municipal agencies. The National Board of Health and Welfare has the right to issue regulations on actions against communicable diseases such as legionellosis.

The Swedish Institute for Infectious Disease Control (SMI), a governmental expert agency, monitors the epidemiological situation for infectious diseases in humans. It is also responsible for promoting protection against such diseases.

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4.3.27. United Kingdom

Introduction

The latest data in UK (June 2009) provide a breakdown of reported cases and fatalities from 1980 to 2008. Table 10 shows an extract (data from 2004 to 2008) from a summary table of the total mean number of cases of Legionnaires' disease in residents of England and Wales expressed as nosocomial, travel-associated or community-acquired cases (data from the Health Protection Agency, HPA).

Table 10: Legionnaires' cases in England and Wales, 2004–2008

Year	Nosocomial			Travel		Community Acquired	Total Confirmed Cases
	Def.	Prob.	Pos.	Abroad	UK		
2004	7 (5)	1	1	149 (36)	24 (8)	136 (19)	318
2005	3 (2)	2 (2)	2	149 (36)	30 (6)	169 (24)	355
2006	2	0	2 (1)	160 (31)	53 (7)	334 (20)	551
2007	8 (4)	1 (1)	3	166 (47)	33 (2)	231 (38)	442
2008	5 (1)	0	3 (2)	126 (20)	26 (6)	199 (28)	359
Total cases 1980-2008	**233 (151)**	**42 (19)**	**50 (2)**	**2754 (571)**	**416 (126)**	**3250 (708)**	**6745**
Total mean 1980-2008	**8.0**	**1.5**	**1.7**	**95.0**	**14.3**	**112.1**	**232.6**

Figures in brackets represent the number of cases associated with outbreaks.

Source: [1]

An extract (data from 2004 to 2008) from a summary table of cases and deaths by sex, below:

Table 11: Cases and deaths by sex, England and Wales 2004–2008

	Total Cases	Male Cases	Female Cases	Sex Unknown	Year	Travel-associated (Abroad & UK)
2004	318	239	79	0	38	173
2005	355	271	83	0	30	179
2006	551	433	118	0	53	213
2007	442	328	114	0	53	199
2008	359	281	78	0	34	152

Source: [1]

The latest data (June 2009) are presented differently, but provide a text summary with supporting tables and figures, examples below:

Of the 68 cases reported in Scotland from 2007 to 2008, 51 (75.0%) were travel related, 10 (14.7%) community acquired, six (8.8%) from an unknown source and one (1.5%) hospital acquired. The number and proportion of community-acquired cases reported in 2007 2008 remained stable following a year-on-year decrease. There were nine (28.1%), seven (21.2%) and six (14.3%) community-acquired cases in 2004, 2005 and 2006 respectively.

Table 12: Legionnaires' cases and deaths in Scotland by sex, 2004–2008

Year	Total Cases	Male Cases	Female Cases	Deaths
2004	32	23	9	4
2005	33	18	15	1
2006	42	32	10	3
2007	43	28	15	1
2008	25	16	9	6

Source: [2]

Legislation

In the UK, all aspects of occupational health and safety are covered by the Health and Safety at Work etc. Act 1974 (HSWA 1974). The HSWA 1974, its subordinate regulations and Approved Codes of Practice (ACoPs) are enforced either by the Health and Safety Executive (HSE) inspectors or by Local Authority environmental health officers in their respective areas of responsibility. Regulations under HSWA 1974 include the Control of Substances Hazardous to Health Regulations 2002 (as amended) (COSHH) [3] and the Management of Health and Safety at Work Regulations 1999 (MHSWR).

COSHH is the mechanism by which the EU Biological Agents Directive is applied in the UK for incidental exposure to biological agents at work. Under COSHH, companies have a legal requirement to control the risks from *Legionella*. The legislative requirements, policies and practices related to *Legionella* control in the UK are summarised in one major document produced by HSE, the Approved

Code of Practice (L8) on The Control of Legionella in Water Systems [4]. This ACoP gives practical advice on the requirements of HSWA 1974 and COSHH, and compliance with the relevant parts of MHSWR regarding the risk from exposure to *Legionella* bacteria.

Those who control premises have a duty under the Notification of Cooling Towers and Evaporative Condensers Regulations 1992 [5] to provide written notification to the Local Authority of cooling towers and evaporative condensers except when they contain water that is not exposed to the air and the water and electricity supply are not connected. If a tower becomes redundant, is decommissioned or dismantled, this should also be notified. This information is then available from the Local Authority to be used in investigations of outbreaks.

Standards

BS 6068-4.12:1998 'Water quality. Microbiological methods. Detection and enumeration of Legionella'. This standard is identical to ISO 11731:1998.

BS 6968-4.18:2004 'Water quality – Detection and enumeration of Legionella. Direct membrane filtration method for waters with low bacterial counts'. This standard is identical to ISO 11731-2:2008

BS 7592:2008 Sampling for Legionella bacteria in water systems. Code of practice.

BS 7592 gives recommendations and guidance on the sampling of water and related materials. It involves testing for the presence of *Legionella*. It applies to sampling artificial water systems and gives methods for sampling of biofilms and sediments that might be present in water systems. Some of the same sampling methods can also be applied to natural water systems.

Policies

The UK is member of the European Working Group for Legionella Infections (EWGLI) and the collaborators are the Health Protection Agency – Centre for Infections (HPA) [6] in England and Wales and the Health Protection Scotland (HPS) in Scotland.

Health and Safety Executive (HSE) [7] works with many organisations to reduce risks and routinely carries out inspections of companies to ensure that controls for *Legionella* are adequate and that workers and the public are protected. HSE seeks to ensure that the risks from *Legionella* are being properly managed in workplaces by pursuing compliance with legislation and by investigating potential occupational sources of *Legionella* in water systems. HSE provides advice on corrective action to control *Legionella* in affected premises, including the issue of legally enforceable improvement notices, and will prosecute if appropriate.

Clinical recognition of cases of Legionnaires Disease is done through the Health Protection Agency (HPA) in England and Wales and Health Protection Scotland (HPS) in Scotland. If a community cluster or outbreak is recognised as having a potential workplace association, HPA or HPS will involve HSE and Local Authority in an incident investigation. HSE will investigate all relevant premises in the outbreak zone, deciding which premises to visit based on local knowledge and those with registered cooling towers. The investigation will focus on identifying at risk water systems and ensuring they do not present a risk to workers or the public and that the potential for further cases of infection are minimised. HSE will ensure compliance with legislation, pursuing enforcement action where necessary, and ensure that adequate arrangements are put into place for the on-going control of *Legionella* risks, if necessary specifying corrective actions to decontaminate water systems and to achieve adequate control. As part of the investigation the Local Authority will take or arrange for samples (including water, swabs, etc.) to be taken at the premises to identify potential sources of *Legionella*.

References and further reading

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4.4. Annex 4 - Other European countries

4.4.1. Norway

Introduction

There have been two *Legionella* outbreaks in Norway associated with industrial facilities. In 2001 the Stavanger epidemic with 26 confirmed cases was caused by a badly maintained cooling tower [1]. In 2005 an outbreak of legionellosis in Sarpsborg killed 10 people and more than 50 people fell sick. An epidemiological study traced the source of the infectious *Legionella* bacteria to an air scrubber at a wood-processing plant, about 10 kilometres from where the outbreak took place [2].

These incidents have drawn attention to *Legionella* risks. In 2006 there was also a suspected Pontiac fever epidemic among sportsmen using a common shower [3]. In Norway general practitioners have to report any single case or outbreak to the municipal medical officer immediately. The information is forwarded to the Norwegian Institute of Public Health.

Legislation

Norwegian legislation concerning *Legionella* has evolved in parallel with Legionnaires' disease epidemics. The country now has detailed regulations on this matter, with strict requirements. The last issue of this regulation was at the end of 2007.

Prevention measures against the spread of Legionella via aerosols ('Kapittel 3a. Krav om å hindre spredning av Legionella via aerosol') is described in chapter 3 of the Environmental Health Order [4]. An amendment made in 2007 (FOR-2007-12-07-1372) contains a chapter dealing exclusively with the prevention of *Legionella* diseases transferred via aerosols. The legislation is applicable for any machine operated by companies that can directly or indirectly spread *Legionella* indoors or outdoors. It does not cover privately owned machines, unless they release *Legionella* to the wider environment.

The order provides a non-comprehensive list of machines that may be a source of *Legionella* (cooling towers, air scrubbers, washing equipment, shower equipment, air-conditioners with humidifiers, indoor humidifiers and fountains, joint hot water supply systems). The designer, constructor and operator are responsible for the safe operation of these machines. Risk assessment and regular maintenance must ber carried out in order to provide satisfactory protection. Water sampling should be done once a month, unless it has been proved that *Legionella* colonisation cannot occur. These machines have to be registered by the local authorities when put into operation, and when they are modified. The aim of the registration is to have a list at hand on possible infection sources in case of epidemic. If *Legionella* colonisation is suspected, microbiological sampling has to be carried out. The owner of the machine finances all these activities.

The Norwegian regulation on biological factors at work [5] is in line with Directive 2000/54/EC.

Standards

NS-EN ISO 11731-2:2008: Water quality – Detection and enumeration of Legionella – Part 2: Direct membrane filtration method for waters with low bacterial counts

Policies

The Norwegian Institute of Public Health (Folkehelseinstituttet) is the collaborator in EWGLI. It recently published an extended guideline on the prevention of *Legionella* diseases [6]. Chapters 1-5 deal with general issues. Chapter 3 deals with risk identification. Risk assessment serves as a basis of any intervention and modification. The company's internal regulations on operation and maintenance have to make use of results from the risk assessment. Concerning the hierarchy of prevention, the priority is the elimination of risks at source. Growth control is a second step, restricted

to situations where elimination cannot be achieved. Chapter 3 also deals with disinfection methods, but it does not specify any occupational health issues. From chapter 6 to 11 there are specific recommendations for machines (cooling towers, showers, etc.). Chapter 12 gives advice on prevention at home. Chapter 13 deals with further items and processes (fountains, spa baths, biofilters, metal machining). Chapters 6–13 deals with the design and construction, risk assessment, operation and maintenance (including disinfection) of the above mentioned machines. It emphasises proper documentation of activities. The texts recommend developing a water treatment plan. There should be regular technical and microbiological supervision of the systems. Prevention is achieved via cleaning and disinfection. There are descriptions of different disinfection methods and materials. They recommend disinfecting before the mechanical cleaning process and disinfecting afterwards again. This would help to prevent inhalation of infective aerosols by cleaning workers. Cleaning should not be done with high-pressure water, in order to avoid excessive aerosol formation. Cleaning workers need respiratory protection. The guideline refers to the recommendation of the Norwegian Labour Inspection Authority to use P3 class filter full face or half masks.

The Social and Health Directorate (Helsedirektoratet) is responsible for producing legislation and has provided a detailed explanatory text on the above-mentioned Environmental Health Order [7]. This website document recommends the sampling of every possible source in cases of infection. A public health specialist physician should investigate any cases. Otherwise the text essentially repeats the above-mentioned criteria and links to websites to be discussed below.

The Norwegian Labour Inspection Authority (Arbeidstilsynet) provides an explanatory document on the order concerning exposition to biological risks at work [8]. It does mention *Legionella* specifically. The Authority has also published a tutorial on biological risks [9]. *Legionella*, among other pathogens, is mentioned as a risk group-2 pathogen that may occur in sewage systems. General hygienic and prevention measures and the use of personal protective equipment is recommended. The document contains no specific prevention measures concerning *Legionella*. There is also a webpage dedicated to *Legionella* at the Authority's site [10]. It starts with a general description of the pathogen and risk sources. The main emphasis of prevention is on cleaning machines and systems. They recommend the use of heat, biocides/chlorine, ultraviolet light and mechanical cleaning. Maintenance workers are identified as being at risk during cleaning. Use of high-pressure water is not recommended. The text on prevention refers to the act on occupational health and safety (Arbeidsmiljøloven [11]): there should be appropriate work description for work that results in risk exposure. The description should focus on work processes, and it should be part of the internal regulation on occupational health and safety of the company.

Risk assessment includes identification of risk factors and prevention measures. Risk assessment is based on the mapping of infection sources, technical knowledge on the machine, recommended and prohibited methods of cleaning. Workers must wear appropriate personal protective equipment. In the case of *Legionella* it is respiratory protection. The Authority recommends full-face mask with P3 filter or full-face mask with an airline respirator. A water resistant (Hazmat) suit and gloves may be used as well. There should be a company's regulation document on the periodical check and maintenance of these equipments in order to provide their appropriate operation.

Related documents are available from the website of the Authority. They were compiled before the last modification of the Environmental Health Act, thus might have outdated recommendations:

'Damp and Legionella' [12] is a presentation containing a risk assessment guide for indoor quality, taking into account among other issues *Legionella*. It also addresses the issue of hot water supply systems.

Another document on *Legionella* and cooling towers [13] contains general information on this matter and refers to the publication of the Norwegian Institute of Public Health. It recommends cleaning of cooling towers and air-conditioners at least twice a year.

There is also a presentation for real estate owners and maintenance workers: 'Legionella and measures' [14]. It provides environmental health basics for risk assessment. The main messages are to keep machines clean, and give a high priority to individual risk assessment of cooling towers.

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4.5. Annex 5 - Non-European Countries

4.5.1. Canada

Introduction

A Canadian study has shown that the average *Legionella* infection rate in healthcare facilities across Canada is 3.2%, with the highest rate of 4.3% in Halifax [1].

Legislation

Occupational Health and Safety Act *1996, c. 7, s. 1.*

Employers have to ensure that equipment, materials and protective devices are maintained in good condition for the prevention of Legionellae growth in water and ventilation systems and to provide information, instruction and supervision to protect workers (e.g. workers involved in preventive maintenance or operation of water and ventilation systems). Employers must take all reasonable precautions for the protection of workers (i.e. identify, assess and implement control measures to prevent Legionellae growth in water and ventilation systems). If an outbreak occurs, the employer must report occupational illnesses to the Ministry of Labour and the Joint Health and Safety Committee (JHSC) in writing within four days.

Regulation for Health Care and Residential Facilities (O.Reg. 67/93, s. 19)

The Regulation for Health Care and Residential Facilities requires that employers, in consultation with the Joint Health and Safety Committee, have to develop, establish and put into effect measures and procedures to protect the health and safety of workers. They should document measures and procedures for the health and safety of workers for the control of Legionellosis and document measures and procedures to safely inspect, clean and maintain water and ventilation systems. They should document measures and procedures for the use, wearing and care of all PPE (whether used by workers who operate, inspect, or maintain water and ventilation systems). In consultation with JHSC, they shall develop and provide training programmes on the measures and procedures.

Personal Protective Equipment (PPE)

Employers shall ensure that workers who are required to wear or use any protective clothing, equipment or device (e.g. to maintain ventilation systems) are trained on its care, use and limitations before wearing or using it. They shall ensure that the protective equipment is properly used, maintained, inspected, stored, and is of appropriate size and fit.

Ventilation

Employers have to ensure that the mechanical ventilation system is inspected every six months by a qualified person to ensure it is in good condition (i.e. no potential for *Legionellae* growth). Copy of the inspection report should be provided to the JHSC. Ventilation shall be serviced and maintained in good condition as recommended by manufacturer or by qualified person as per inspection report

Standards

- CSA Standard CAN/CSA-Z317.2-01

  Standard CAN/CSA-Z317.2-01 specifies special requirements for heating, ventilation, and air-conditioning (HVAC) systems in healthcare facilities.

- CSA Standard CAN/CSA-Z317.13

Standard CAN/CSA-Z317.13 specifies infection control during construction or renovation of healthcare facilities.

- CSA Standard CAN/CSA-Z317.1-99

  Standard CAN/CSA-Z317.1-99 specifies special requirements for plumbing installations in healthcare facilities.

Policies

Health Canada

Health Canada is the Federal department responsible for helping Canadians maintain and improve their health. Health Canada collects information about the number of cases of legionellosis in Canada as part of its work with provincial and territorial public health officials to monitor and analyse the incidence of infectious diseases. Health Canada also develops guidelines to prevent and control the spread of infections acquired in healthcare facilities, such as hospitals. When requested, Health Canada also helps to investigate outbreaks of infectious diseases. In addition, Health Canada participates in public information initiatives, and works globally with other countries to develop and implement strategies to reduce or eradicate infectious diseases [2].

The Ministry of Labour

The Ministry of Labour (MOL) coordinates with public health institutions where there is joint jurisdiction (i.e. when workers are involved). The Ministry of Labour investigates to ensure that the employer takes appropriate precautions to protect workers and prevent a recurrence. The MOL also has a proactive role to ensure employers take steps to prevent workers' exposure and illness. The Ministry of Labour develops a common approach to *Legionella* prevention with the Ministry of Health and Long-Term Care.

References

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4.5.2. United States of America (USA)

Introduction

The Center for Disease Control and Prevention (CDC), which is one of the major operating components of the US Department of Health and Human Services, estimates that between 10,000 and 20,000 cases of Legionnaire's disease occur each year in the United States. Of these, 1,500 to 1,800 are reported to public health authorities. There has been a general increasing trend in the number of cases reported per year, which is probably due to improvements in physicians' ability to diagnose the disease associated with introduction of new diagnostic assays.

More than 30 years have passed since the recognition of *Legionella* species as the cause of a severe pneumonia outbreak in Philadelphia in 1976. Since then, great progress was made in understanding this disease and its environmental sources. Despite this, an abrupt increase in the incidence of legionellosis has been noted since 2003, with recent increases in the Bronx prompting the New York City Department of Health to issue a press release in July 2007.

A total of 23,076 cases of legionellosis were reported to the CDC from 1990 through 2005.

The annual number ranged from 1,094 to 2,291 cases. The number of reported cases increased by 70%, from 1,310 cases in 2002 to 2,223 cases in 2003, with a sustained increase to >2,000 cases per

year from 2003 through 2005. During 1990–2002, the mean (±SD) annual legionellosis case count was 1,268 ± 139.40 cases (range, 1,094–1,610 cases), whereas from 2003 through 2005, the yearly mean was 2,198 ± 107.15 cases (range, 2,081–2,291 cases). The age-adjusted incidence rate for legionellosis in the United States paralleled this rise, increasing 65%, from 0.45 cases per 100,000 residents in 2002 to 0.75 cases per 100,000 in 2003 [1].

Legislation and Policies

In the USA the first CDC 'Guideline for (the) Prevention of Nosocomial Pneumonia' was published in 1981 and addressed the main infection-control problems related to hospital-acquired pneumonia at the time (use of large-volume nebulisers that were attached to mechanical ventilators and improper reprocessing of respiratory-care equipment).

In 1994, the CDC proposed guidelines/recommendation to prevent and control nosocomial pneumonia including Legionnaires' disease [2]. These guidelines were most recently updated in 1997 [3, 4]. The 'Guidelines for Prevention of Nosocomial Pneumonia' [4] advocates active surveillance and good case-finding strategies in hospitals, including the establishment of appropriate diagnostic capabilities for *Legionella*. CDC guidelines also note the need for routinely maintaining cooling towers [5].

The next draft of CDC 'Guidelines for Prevention of Nosocomial Pneumonia' [6] expands on and replaces the previously published [4]. This revised guideline addresses common problems encountered by infection-control practitioners regarding the prevention and control of nosocomial pneumonia in US hospitals. New sections on Legionnaires' disease have been included.

The latest document of CDC 'Guidelines for Environmental Infection Control in Health-Care Facilities' [7] incorporates discussions of air and water environmental, consolidates relevant environmental infection-control measures from other CDC guidelines and includes two topics not addressed in previous CDC guidelines: infection-control concerns related to animals in healthcare facilities and water quality in haemodialysis settings.

Part I of this report, *Background Information: Environmental Infection Control in Health-Care Facilities*, provides a comprehensive review of the scientific literature.
Part II, *Recommendations for Environmental Infection Control in Health-Care Facilities*, outlines environmental infection control in healthcare facilities, describing measures for preventing infections associated with air, water, and other elements of the environment.

Primary Prevention of Legionnaires' Disease (no cases identified)

Healthcare facilities use at least two general strategies to prevent healthcare-associated legionellosis when no cases or only sporadic cases have been detected. The first is an environmental surveillance approach involving periodic culturing of water samples from the hospital's potable water system to monitor for *Legionella* spp. If any sample is culture-positive, diagnostic testing is recommended for all patients with healthcare-associated pneumonia. If >30% of the samples are culture-positive for *Legionella* spp., decontamination of the facility's potable water system is warranted. The premise for this approach is that no cases of healthcare-associated legionellosis can occur if *Legionella* spp. are not present in the potable water system, and, conversely, cases of healthcare-associated legionellosis could potentially occur if *Legionella* spp. are cultured from the water. Physicians who are informed that the hospital's potable water system is culture-positive for *Legionella* spp. are more likely to order diagnostic tests for legionellosis.

The second strategy to prevent and control healthcare-associated legionellosis is a clinical approach, in which providers maintain a high index of suspicion for legionellosis and order appropriate diagnostic tests for patients with healthcare-associated pneumonia who are at high risk for legionellosis and its complications [8].

Secondary prevention of Legionnaires' Disease (with identified cases)

The indications for a full-scale environmental investigation to search for and subsequently decontaminate identified sources of *Legionella* spp. in healthcare facilities without transplant units have not been clarified; these indications depending on the facility.

At last, some States have elaborated own guidelines [7, 9].

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4.5.3. Japan

Introduction

From January 2003 to the end of September 2008, 2,460 legionellosis cases were reported. Since 2005, the reported cases have markedly increased. This increase is attributed to the application of antigen-detection in urine by enzyme immunoassay from 2003, immunochromatographic assay from 2004, and the adoption of 'Guidelines for the Management of community-acquired pneumonia in adults' in October 2005.

According to the Health and Consumers Directorate-General of the European Commission the number of cases of legionellosis (and the incidence per 100,000 of population) for Japan is 56 (0.7) for 1999, 154 (1.0) for 2000, 86 (1.3) for 2001, 167 (1.7) for 2002, 146 (1.7) for 2003, 162 (1.9) for 2004, 281 (2.4) for 2005 and 508 (2.3) for 2006 [1].

Legislation

According to the Industrial Safety and Health Law, No. 57 dated June 8 1972 (as amended by Law No. 25 of 31 May 2006), the employer should take necessary measures for preventing health impairment due to pathogens, etc.
Where it is deemed necessary to take comprehensive improvement measures for the prevention of industrial accidents, the Director of the Prefecture Labour Bureau may instruct the employer, as stipulated by the Ordinance of the Ministry of Health, Labour and Welfare, to prepare an improved plan concerning safety and health in the workplace.

When the plan is being drawn up the employer has to take into account the opinion of the trade unions or the opinion of those representing a majority of the workers where such a trade union does not exist. Risk assessment should be carried out according to the prescriptions of the above Ordinance.
The Work Environment Measurement Law No. 28 of 1 May 1975 (as amended by Law 160 of 22 December 1999) specifies that tests to monitor the quality of the work environment must be carried out by authorised experts or associations. Nevertheless, no special reference is made to *Legionella* monitoring.
Legionellosis has been classified as a category IV infectious disease under the National Epidemiological Surveillance of Infectious Diseases (NESID), which is based on the Infectious Diseases Control Law. Physicians must notify legionellosis cases.

The revised Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections (the Infectious Diseases Control Law) was promulgated on 8 December 2006. The law contains new articles on the handling of pathogens. In addition, it contains a revised list of categories of infectious diseases.

Policies

Mandatory notification of legionellosis, research efforts for better clinical inspection of the disease, as well as efforts to inform the general public, are among the measures taken to protect the population from *Legionella*.

Legionella problems in the field of occupational health and safety are difficult to face because there are no specific references available and the problem is tackled through general protective and preventive measures. In public health issues, provisions are more specific. Food safety is also considered when combating *Legionella*. Monitoring and guidance are performed on the basis of the Law Concerning Standardisation and Proper Labelling of Agricultural and Forestry Products (the JAS Law) to ensure the safety of foods.

Several guides have been published in Japan to inform people on good practice in combating *Legionella* infections. The Legionnaires' Disease Code of Practice, Guideline for Prevention and Control of *Legionella* Infections was issued by the Environmental Health Bureau of the Japanese Ministry of Health and Welfare in March 1994. The Tokyo Metropolitan Institute of Public Health has published a brochure titled 'Programs Guide' that gives information on fighting exposure to biological agents, including *Legionella* [2].

Standards

Standard No. JIS K 0350-50-10: 2006 – 'Testing method for detection and enumeration of Legionella in industrial water and waste water' was drawn up by the Japanese Standards Association; it is based on the International Standard No. ISO 11731:1998 – 'Water quality – Detection and enumeration of Legionella', with some modification of the technical contents.

JIS K 0350 series consists of nine parts. JIS K 0350 specifies the testing method for detection and enumeration of *Legionella* in industrial water and waste water.

Japanese Standard No. JIS K 0430-72-10:2000 – 'Water quality – Enumeration of viable microorganisms -- Colony count by inoculation in or on a nutrient culture medium', is based on International Standard No. ISO 6222:1988 – 'Water quality – Enumeration of culturable microorganisms – Colony count by inoculation in a nutrient agar culture medium'.

References and further reading

[1] http://ec.europa.eu/health/ph_information/dissemination/echi/docs/legionellosis_en.pdf

[2] Tokyo Metropolitan Institute of Public Health – Programs Guide

[3] Yaeko Mitsumori – Senior Science & Technology Officer British Embassy, Oct 2004 – Infectious Diseases in Japan – an overview of current activities

[4] International Performance Measurement and Verification Protocol Committee, January 2001 – International Performance Measurement & Verification Protocol, Concepts and Practices for Improved Indoor Environmental Quality

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[6] Nobuhiko Okabe – Infectious Disease Surveillance Center, National Institute of Infectious Diseases, Tokyo – Infectious disease surveillance designated by the Infectious Disease Control Law, and the situation regarding emerging/re-emerging infectious diseases in Japan

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4.5.4. Australia

Introduction

Analysis of stored samples has enabled confirmation that Legionnaires' disease was in evidence in Australia in 1974 [1], some two years before it was named following the outbreak at a conference of Legionnaires in Philadelphia USA in 1976. Both, sporadic and epidemic forms of Legionnaires' disease occur in Australia with the causative agent being split equally between *L. pneumophila* and *L. longbeachae*. *Legionella* infections are believed to account for 5–15% of community-acquired pneumonias (Victorian Government Health Information Blue Book).

The National Notifiable Diseases Surveillance System (NNDSS) publish data for all notifiable diseases as part of the quarterly publication *Communicable Diseases Intelligence* (CDI). The number of cases of Legionnaires' disease was in 2008 266, significantly lower than the average over the previous five years of 326,2 cases. Most cases occurred in New South Wales (86/266), Western Australia (63/266) and Victoria (53/266) whereas Tasmania had no reported cases in 2008. (CDI March 2008-March 2009) [2].

Legislation

Australia consists of eight states or territories that are self-governing in respect to public and occupational health matters. This includes independent regulations and guidance for the control of *Legionella* and the provision for enforcement. However, all states refer to the Australian / New Zealand Standard 'Air-handling and water systems of buildings – Microbial control'. The focus of *Legionella* control in Australia is on cooling tower management and warm water storage systems.

The legislation, guidelines and responsible authorities for the individual Australian states and territories are outlined in Table 13.

Table 13: Overview of *Legionella* legislation by Australian state or territory

Jurisdiction	Acts	Regulations	Standards, codes or guidelines	Responsible Agency	Enforcement agencies
Queensland	Workplace Health & Safety Act 1995	Workplace Health & Safety Regulations (2008)	Plant Advisory Standard suppl no. 2 (2005) '*Legionella* control in air-conditioning units & cooling towers' AS/NZ 3666	Dept of Industrial Relations	DIR-Div. of Workplace Health & Safety
New South Wales	Public Health Act 1991	Public Health (Microbial Control) Regulation 2000	Code of Practice for the Control of Legionnaires' disease Code of Practice-Thermostatic mixing valves in healthcare buildings AS/NZ 3666	NSW Health Dept. &Local Government	NSW Health Dept & Local Government
Victoria	Health Act 1958	Health (*Legionella*) Regulations 2001	Guidelines for the control of Legionnaires' disease	Dept of Human Services	Dept of Human Services
	Building (*Legionella*) Act 2000	Building regulations 1994	Building Code of Aust- F4.5 & 11.2 & AS/NZ 3666	Building Control commission	Authorised officers
		Building (*Legionella* Risk management) regulations 2001	A guide for developing risk management plans for cooling tower systems Managing the risk of Legionnaires' disease: supplementary notes for hospitals	Department of Human Services	Department of Human Services
		Building (Cooling Towers Register) regulations 2001	Guide to registering a cooling tower system		
		Plumbing (Cooling towers) regulation 2001	AS/NZ 3666 (Mechanical services work only)	Plumbing Industry Commission	Plumbing Industry Commission

Jurisdiction	Acts	Regulations	Standards, codes or guidelines	Responsible Agency	Enforcement agencies
			A Code of Good Practice for the servicing, maintenance & recommissioning of mechanical services plant & equipment Technical solutions 6: Hot water plumbing Technical solutions 7: Mechanical services		
Tasmania	Public Health Act (1997)		Guidelines for *Legionella* (2001)	Department of Health & Human Services	Department of Health & Human Services
South Australia	Public & Environmental Health Act (1987)		AS/ NZ 3666 and HB-32 as base reference documents AS/NZ 3500.4.2 Standard for the control of *Legionella* in manufactured water systems in South Australia	Department of Human Services (DHS)	Local Government & DHS in unincorporated areas
	Development Act (1993)	Building Code of Australia	AS/NZ 3500.4.2	Local Government Dept for Transport, Urban planning and the Arts (DeTUPA)	Local Government (DeTUPA in unincorporated areas
Western Australia	Health Act 1911	Health (Air handling and water systems) regulations 1994	AS/ NZ 3666	Health Department of WA	Local government
Australian Capital Territory	Public Health act 1997		ACT Cooling towers and warm water storage systems code of practice 2000	ACT Dept of Health, Housing and Community Care	ACT Dept of Health, Housing and Community Care

Jurisdiction	Acts	Regulations	Standards, codes or guidelines	Responsible Agency	Enforcement agencies
Northern Territory	Public Health Act 1952 Work Health act 1986	Buildings regulations 1993	Building Code of Aust F4.5 & 11.2, 1668.2 & AS/NZ 3666.1 Guide on Legionnaires' disease Guidance for the control of *Legionella* - NEHF	Department of Lands Planning & Environment Dept of Industries & Business Territory Health Services	Department of Lands Planning & Environment Dept of Industries & Business Territory Health Services

Source: [3]

Cooling towers are required to be registered within all Australian states with the exception of Western Australia and the Northern Territory. Registration is with the respective state registering authority.

The Building Code of Australia [4] is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and State and Territory Governments. The BCA contains technical provisions for the design and construction of buildings and other structures and includes aspects of *Legionella* control in sections F4.5, 11.2 and 1668.2. The State of Victoria and the Northern Territory refer these to.

Standards

Despite different approaches to legislation and enactment, the primary reference document used to facilitate *Legionella* control measures in Australia is the Australian / New Zealand Standard 'Air-handling and water systems of buildings-Microbial control'. This is divided into three parts as follows:

- Part 1: Design, installation and commissioning (AS/NZS 3666.1.2002)
- Part 2: Operation and maintenance (AS/NZ 3666.2.2002)
- Part 3: Performance-based maintenance of cooling water systems (AS/NZ 3666.3.2000)

AS/NZ 3500.4.2 National plumbing & drainage Part 4.2 Hot water supply systems. Acceptable solutions. This is referred to by the state of South Australia

Standards Australia: HB32-1992 'Control of microbial growth in air-handling and water systems in buildings' (1992). This standard states that an acceptable level for *Legionella* contamination of cooling tower water is below 100,000 CFU/ml. This is referred to by the state of South Australia

Policies

Legionnaires' disease is a notifiable disease throughout Australia and each state or territory informs the National Notifiable Diseases Surveillance System (NNDSS) of confirmed cases of *Legionella* according to a case definition.

References

[1] Gilligan J et al (1980) Legionnaires' disease in South Australia. Four case reports; Medical Journal of Australia 1(8), 368 – 71, Communicable disease intelligence (CDI) Quarterly reports, Communicable Diseases Surveillance Table 2 'Notifications of diseases received by State and Territory health authorities'

[2] Victorian Government Health Information Blue Book (www.health.vic.gov.au/ideas/bluebook/legionellosis)

[3] Builders Guide to Operations and Maintenance Manuals appendix 1 (www.webfm.co.au/Downloads/The_Builders_Guide_to_OM_booklet.pdf)

[4] The Australian Workers' Union – Infectious Diseases http://sa.awu.net.au/63.html?3